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ABSTRACT

As part of a 3-year comprehensive interdisciplinary program in industrial preparation for vocational students, this 11th Grade teaching guide consists of units on technical mathematics and guidance. Designed as supportive material for related physics and English curriculums, the first four sections of Volume 4 on algebra, vectors, simple machines, and electricity stress fundamental concepts by means of daily lesson plans. Accompanied by classwork and cocurricular assignment worksheets and tests, the 117 mathematics lessons are illustrated with detailed line diagrams. Meaningful self-appraisal through group and personal guidance, leading to a successful occupational choice is the aim of a guidance unit which describes the functions of interests, aptitudes, needs, motivations, and attitudes in career planning. Further insight into human relations is provided by a discussion of prejudice and steps for solving problems. Case studies, references, project lists, and worksheets also enrich this guidance unit. Volume 4 is planned for use with four others, available as VT 015 227-VT 015 231 in this issue. (AG)

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INDUSTRIAL PREP

Volume Four

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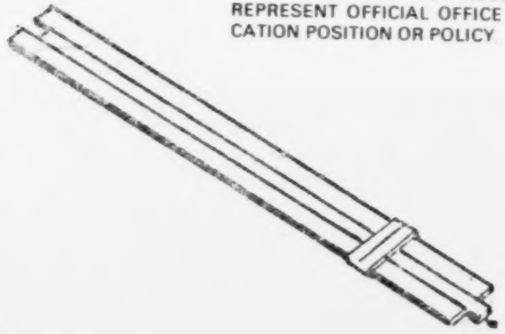

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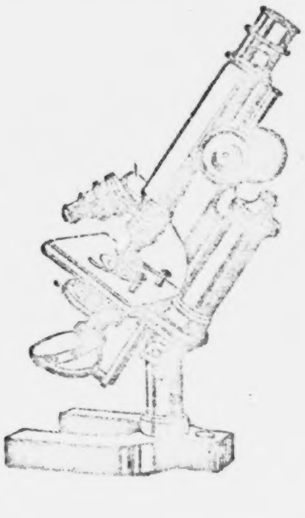

Junior Year

CONTENTS: MATHEMATICS
GUIDANCE

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GUIDANCE

INDUST. PREP.
VOL. 4 JUNIOR YR.

Introduction
Function of Guidance

In our modern complex society it is becoming extremely difficult for many students to make realistic vocational choices. The problem is partly due to the fact that many students do not understand themselves or the demands of the job. Adding to the difficulty in choosing ones life work are the numerous varieties of occupations. The Dictionary of Occupational Titles lists over 22,000 job titles describing the nature of work.

In an effort to understand the changing world of work a course in Occupations is currently being taught to tenth grade students in the Industrial Prep Program. The eleventh grade Industrial Prep Program will supplement the course in Occupations since students' needs, perceptions skills and interests are changing. This will be done through a work preparation unit in English.

The choice of a realistic and satisfying occupation can not be overemphasized. Karl Menniger a leading psychiatrist has asserted that "perhaps three fourths of the patients who come to psychiatrists are suffering from an incapitating impairment of their satisfaction in work or their ability to work."

The central task of guidance is to make the individual aware of himself. The teaching of occupations or investigation of careers will be of no avail if the individual has little or no self understanding. For this reason guidance must actively involve the student in those situations which aid him toward a clearer and more realistic self appraisal.

This approach resembles Super's contribution in the field of vocational guidance. Super asserts that the act of choosing an occupation constitutes an implementation of the self-concept. This program enables the student to develop a more realistic image of himself. As this development continues the student can say "This is the kind of person I seem to be," then the next step is to say, "Therefore, this is the kind of work I might do and enjoy!"

There is general agreement on the necessity for reality testing as a part of occupational choice. Eventually all students will test their occupational choice against the realities of occupational life when they try to make a living. Many times a student needing a job will take one which happens to be available at the time. The student may find himself in a job situation for which he is ill equipped and unprepared. This type of accidental job choice may eventually lead a person to seek the services of Dr. Menniger or one of his associates.

Through the Industrial Prep Program students are given a real choice which is based on experience, observation, and reality testing through a work study program. This program has been formulated in an attempt to reduce the element of chance to the smallest possible margin while at the same time increasing the amount of choice.

The councelor will use two types of counseling in an effort to promote greater self awareness and understanding. Counceling will be done in the traditional one to one basis since many problems are best resolved in this manner. However the counselor will also aid the student in quest of greater self-realization through the use of group guidance and counseling procedures for both reasons of expediency and value.

The time of a counselor is usually at a premium due to the large number of students and many functions under his administration. Beset with these conditions counselors have found that they are able to make judicious and effective use of time by scheduling groups of students who have common problems. The expediency of group guidance and counseling is readily apparent.

The use of group guidance in helping individuals in the solution of their problems has much value. The knowledge that others in the group have common problems helps the individual realize that he isn't the only person facing these difficulties. Many of our students will become members of various work groups. They will be expected to function together as a team and make meaningful decisions with the group. The counselor is afforded an opportunity to present topics of personal and social relationships for group study, discussion, and decision making.

Many favorable results have been produced from group guidance and counseling procedures.

1. Students get the view of the majority and minority on personal and social matters.
2. The pupil is afforded an opportunity to think for himself and defend his opinions.
3. Through the use of current, interesting and real life situations shy students may become excited and involved in discussions.
4. Pupils become greatly aware of their feelings because they are actively involved in the group.
5. Students obtain a clearer self image of themselves due to projecting and defending their thoughts within the group.

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UNIT ON INTEREST

I. Objectives

1. Show the relationship of achievement and aptitude to interest.
2. Encourage students to develop new or varied interests.
3. Have students analyze their interests in relation to actual occupations.
4. Illustrate that interest in a job is an important factor of job satisfaction and success.

II. Nature of Interests

A. Define Interests

1. Preferences (likes)
2. Expressed actions

    a. situations
    b. things
    c. ideas
    d. people
    e. events

B. Interest as a factor in career success

1. Interest and no aptitude

    a. not sufficient for success
    b. Example: Interest in becoming a draftsman but poor spatial perception
    c. Example: Interest in basketball but poor coordination

2. Aptitude and no interest

    a. not sufficient for job satisfaction
    b. Example: Good mathmatical ability but interest in law.

3. Interest and aptitude

    a. combination for success
    b. Example: An interest in sales combined with a verbal ability

III. Influences on Interest

A. Study of Careers

1. Exposes students to new interests.
2. Clarifies interests which are based on a superficial basis.

- B. Family Influences
  - 1. Family conversations
    - a. likes
    - b. dislikes
  - 2. Vocations of family members
- C. Hero Worship
  - 1. Identification with a hero
  - 2. Someone who possesses certain ideals or achieved the type of success one seeks
    - a. movie star
    - b. athlete
    - c. entertainer
    - d. president
    - e. etc.
- D. Philosophy of Life
  - 1. Objectives and values influence interests.
  - 2. As goals change so do interests.
    - a. Example: 7 year old student is interested in bicycles.
    - b. Example: 17 year old student is interested in cars.
- E. Aptitudes
  - 1. Qualities of Aptitudes
    - a. developed capabilities
    - b. undeveloped capabilities
  - 2. Success brings satisfaction.
  - 3. Interest is high in those things we do well.

IV. Developing Interests

- A. Increasing knowledge of careers and occupations.
  - 1. Reading containing information on careers
  - 2. T.V. films on vocations
  - 3. Subjects in school
- B. Actual Experience
  - 1. Part time jobs
  - 2. Volunteer work
- C. First-Hand Viewing
  - 1. Observation of actual work experience
  - 2. Motion pictures depicting actual work experiences

D. Experiences of Others

    1. Lectures

        a. plant tours
        b. career days

    2. Interview (informal discussion) with those in vocation.

V. Interests are revealed in our actions.

A. Hobbies

    1. Collecting things

        a. cars
        b. clothing
        c. girls

    2. Building things

        a. car motors
        b. radio sets

B. Leisure-Time Activities

    1. Types of T.V. programs
    2. Types of movies
    3. Types of books one reads
    4. Types of recreation
    5. Types of hobbies

C. Vocation

    1. Types of traveling
    2. Destination
    3. Activities

D. Athletic Activities

    1. Participation as a player
    2. Indirect participation

        a. coaching
        b. officiating

    3. Spectator

E. Extracurricular Activities and Avocations

    1. School

        a. clubs
        b. athletics

2. Community organizations

a. youth council
b. volunteer ambulance corp

VI. Types of Interests

A. Mechanical

1. Manual and manipulative interests
2. Related activities

a. application of technical knowledge by doing physical activities
b. machine operators, craftsmen

B. Computational - Mathmatical

1. Numerical interests
2. Related activities

a. accountant
b. banker
c. physics
d. engineering

C. Scientific

1. Physical

a. interests in matter
b. interests in motion

2. Biological

a. interests in plants
b. interests in animals

3. Chemical

D. Persuasive

1. Interest in people
2. Related activities

a. oral

(1) sales
(2) radio

b. visual

(1) t.v.
(2) motion pictures

c. written

(1) advertising
(2) writers

E. Artistic

1. Aesthetic interests
2. Related activities

a. designing
b painting
c. illustrating

F. Literary

1. Interest in writing and language
2. Related activities

a. journalism
b. law
c. translating
d. interpreting

G. Musical

1. Interest in Music
2. Related activities

a. composing
b. singing
c. playing an instrument
d. dancing
e. chorus

H. Sociological

1. Interest in people
2. Related activities

a. teaching
b. religion
c. social work
d. personnel
e. psychology
f. government

I. Commercial

1. Interest in business
2. Related activities

a. clerks
b. managers
c. owners
d. purchasers

Unit on Interest

Suggested Activities and Projects

1. Discussion on where interests originate. Are your interests inherited from your parents? What are five interests you have in common with your parents? List at least five interests you do not share with your parents.

2 2. From your survey of occupations in your English work study unit you are to answer the following questions.

   a. Is it possible to find people possessing the same interests in different vocations?

   b. Is it possible to find people possessing different interests in the same vocations?

If your answer is yes to either of these questions you should give specific examples.

3. How may interests influence ones educational, social and vocational plans? Observe friends and adults whose plans have been affected by their interests.

4. Should a person continue in an occupatinn in which he is not interested? What are the chances of his success if he does? Will he become interested in it if he keeps at it long enough? Can a lack of interest be overcome? How many interests and abilities be related?

5. Ask 3 persons who are interested in their work whether their interests came before they began to work or afterwards? Tabulate the findings of the class in a frequency distribution.

6. The class will take the S.V.I.B. From the results of the S.V.I.B. the students will be grouped according to common interests. The students will be required to investigate job opportunities on the basis of their group interests.

Case Study

When John received his report card, he found deficiencies in English, mathematics, and history. He is a boy of unusual artistic ability who is always willing to contribute to all school activities where his talents can be utilized. He makes posters for plays and is a member of the orchestra, band, and glee club. His mother came to school to consult his teachers because John couldn't explain why he had failed. After conferring with the teachers she found that her son has seldom had his homework done on time, and almost never had a lesson prepared unless continually checked by the teacher.

Issues involved

1. Is it fair for the teachers to penalize John when he gives so much of his time and talent to his school?

2. Should he take part only in those subjects which he likes and for which he shows special ability? Why bother with subjects in which he is not interested?

3. Is it necessary to emphasize passing in these subjects? Are there some subjects in which it is not necessary to do your best?

4. If he is planning to be an architect or cartoonist or musician, what need will he have for the subjects in which he has failed?

5. What should the school do to help him meet the situation successfully? Can John help himself to overcome these difficulties? How? What, if anything, should his parents do to help him?

6. Is John developing any undesirable attitudes or habits? What, if any?

7. What will probably happen in the future if he fails to face this situation frankly?

Usually the class is sympathetic and indulgent with John at first. Gradually they accuse him of self-indulgence, quitting, laying down on the job, and sacrificing for immediate advantages. His attitude is short-sighted, unfair to parents and school, and sure to result in disappointment for himself. He must not get himself into habits of slovenly work, self-indulgence, and procrastination. These habits account for many failures. He must face the situation frankly, like a man, and do something. It is right and necessary for the school and his parents to insist on his maintaining a reasonable standard in his academic work before engaging in outside activities. Even athletes must maintain eligibility standards. He must not dissipate his energies. Pleasing and accommodating teachers is not necessarily getting an education.

The teacher does not owe a good mark to an accommodating pupil who has not mastered the course, but that teacher should put John's education before his activities.

Allen, R.E. Case Conference Problems in Group Guidance. New York: Inor Publishing Company, 1933.

Students Name
Handout Sheet #1

Date
Interest Log

Interest Log

	Like to do in each	Dislike in each
School Subjects		
Hobbies		
Leisure Time Activities		
Vacations		
Athletic Activities		
Jobs held		
Extra-curricular Activities (Clubs & Activities)		
Types of Books read		

Students Name
Handout Sheet #2

Date
Development of Interests

Some interests in our lives change quite easily while others remain constant. In evaluating your own experience relate those interests that have remained constant and those which have changed. In filling out the chart below you will be asked to explain why some of your interests have not been discarded while others have been.

Analysis of Interests

	Constant Interests	Reasons why interests have remained constant	Discarded Interests	Reasons why interests have been discarded
1.	automobiles	I have always liked speed & excitement	photography	It is too expensive and tedious.
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Interest References

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2. Peterson, Eleanor. Successful Living. Chicago: Allyn and Bacon, 1959. Chapter 23.
3. Robinson, Clark. School and Life. New York: Macmillan, 1952. Part VII.
4. Smith, Leonard. Career Planning. New York: Harper & Brothers, 1959.
5. Strang, Ruth. Educational Guidance. New York: Macmillan, 1947. Chapter 3.
6. Discovering Myself. Chicago: National Forum, 1956. Chapter 32.

VISUAL AID:

1. You and Your Work (Coronet)

Aptitudes

I. Objectives

1. Illustrate the relationship between abilities and aptitudes.
2. Enable students to recognize that all jobs require various aptitudes.
3. Encourage and aid students in analyzing their aptitudes.
4. Enable students to use a knowledge of their aptitudes in career planning.

II. Meaning of Aptitudes

A. Define Aptitudes

1. potential
2. ability

B. Difference between aptitude and ability

1. Aptitude

a. natural tendency
b. to learn something

(1) aptitude to learn mechanical reasoning.
(2) aptitude to learn and differentiate musical sounds.

2. Ability

a. A + T = A (Aptitude + Training = Ability)
b. learned
c. present skill

(1) example--ability to rebuild an engine
(2) example--ability to play a musical instrument

C. How can one determine his aptitudes

1. school aptitude tests
2. ones achievements

a. high grades in art may be indicative of an aptitude in art
b. playing on the baseball team may be indicative of a manual aptitude

III. Developing Aptitudes

A. Methods of development

1. practice or use them
2. training

a. school
b. work

B. How can aptitudes be impaired

1. age
2. disease
3. overuse
4. lack of use

IV. Manual Aptitudes

A. What are manual aptitudes

1. capacity to perform
2. muscular tasks
3. manipulative tasks
4. physical tasks

B. Physical Capacities

1. physical dexterity
2. related activities

a. tool-making
b. die-making
c. watchmaking

C. Co-ordination

1. muscular control
2. hand-eye
3. hand-foot
4. related activity

a. punch operator
b. sports car driver

D. Rhythm

1. smooth muscular functioning
2. related activity

a. violinist
b. pianist

E. Strength

1. exerting muscles
2. related activities

a. boxing
b. football
c. laborer

F. Speed of Movement

1. Swiftness of muscle movement
2. related activity

a. packer
b. surgeon
c. assembler
d. boxer

G. Steadiness of Movement

1. sure balance
2. related activity

a. juggling
b. waitress
c. surgeon

H. Stamina

1. Endurance qualities
2. related activity

a. boxing
b. truckdriver
c. laborer

V. Mental Aptitudes

A. Important in career planning

1. Mental activities are made up of various factors.
2. Different occupations require various types of mental aptitudes
3. Knowledge of mental aptitudes are necessary for realistic career planning.

B. Abstract and Verbal Reasoning

1. ability to grasp ideas
2. comprehend verbal relations
3. essential for learning

C. Spatial Relations

1. Visualize objects and forms in the mind

a. shapes
b. sizes
c. characteristics

2. Related Activities

a. engineering
b. art
c. designing

D. Numerical or Arithmetical Reasoning

   1. Capacity to compute figures or numbers
   2. Expression of ideas or forms in mathmatical formulas
   3. Understanding relations between numbers and formulas
   4. related activities

      a. engineering
      b. physics
      c. data processing

E. Mechanical Comprehension

   1. visualize movement and motion
   2. ability to grasp and apply mechanical principles
   3. related activities

      a. mechanical engineering
      b. machine operating
      c. designing machines
      d. mechanical trades

F. Musical Discrimination

   1. sense of hearing
   2. ability to distinguish between sounds one hears
   3. related activities

      a. musicians
      b. composers

VI. General Intelligence

   A. What is it

      1. No one accepted definition by all
      2. ability to understand and use ideas
      3. composed of various factors

         a. mental alertness
         b. common sense
         c. verbal intelligence
         d. ingenuity
         e. educability
         f. memory
         g. concentration
         h. reasoning

   B. Mental Alertness

      1. grasping ideas quickly
      2. related activity

         a. consulting work
         b. repair work

C. Common Sense

1. application of knowledge to solution of daily problems
2. ability to solve new problems

D. Verbal Intelligence

1. power to reason
2. power to understand directions

E. Ingenuity

1. ability to devise new methods and techniques
2. related activity

   a. designer
   b. methods engineer
   c. repair man

F. Educability

1. capacity to learn
2. When known it can help predict your chances of success

G. Memory

1. capacity to focus attention on one task
2. ability to resist distractions

I. Reasoning

1. organize facts
2. explore facts
3. drawing a meaningful conclusion based upon these facts

VII. How does a person know if he has the aptitude for studying beyond high school

A. Methods of obtaining information

1. Rank in class
2. Results of tests

   a. academic aptitude
   b. educational achievement

3. Comparison of academic aptitude tests

   a. below average technical or college student
   b. equal to average technical or college student
   c. above average technical or college student

4. Belief of teachers

   a. probability of success in college
   b. probability of success in trade school

5. Condition of health
6. Follow up alumni
    a. Those with similar background
    b. Those who have gone to the school of your interest.

Unit on Aptitudes

Suggested Activities and Projects

1. The class will devise their definitions of aptitude and ability. Students should attempt to give examples of each prior to class discussion and investigation of aptitudes.

2. Does everyone possess the ability to do some things well? Can most of us do everything well? In your opinion are abilities as important as interests?

3. The D.A.T. will be administered to all students. Those students who have common aptitudes will be separated into groups, which will investigate job opportunities on the basis of their aptitudes.

4. Motion Picture Investigation

Students who are interested in photography may volunteer for this project. Students will investigate jobs in their own community. They will take 8 mm or 16 mm movies of people involved in various occupations. From these films students will be asked to list the types of aptitudes and abilities which the workers are illustrating.

5. The teacher will prepare a series of cards. The cards will present various details of fictitious individuals. Students are to attempt to predict the occupation which would fit this fictitious student.

This activity will emphasize two important points. First, the students will realize that a great deal of information must be investigated before a person can make a meaningful job choice. This will be clearly illustrated as students will experience difficulty in predictions until sufficient

Suggested Activities and Projects (continued)

information has been presented. Secondly students will be aware that aptitudes can be derived through an investigation of ones achievements.

6. To what extent do students believe that abilities are inherited or learned. Students will investigate their aptitudes which seem to be inherited, basically the same as their parents. They will also determine those abilities which are different from their parents and attempt to explain how the similarities and differences occured.

7. Work out a formula for making an unwise choice of an occupation.

Example--
- a. work one knows nothing about
- b. work outside your interests
- c. work outside your abilities

Ask the students why this is an unwise way of selecting a job. Can any students recount from their experience any friends, relatives or people who made their choices in this manner? What were the results?

8. Each student will determine if he has the aptitude for studying beyond high school.

	poor	fair	average	good	excellent
	1	2	3	4	5
Rank in class					
Results of tests					
Comparison of Aptitude Tests					
Belief of Teachers					
Condition of Health					
Comparison of Successful alumni					

Total ☐

How do you rank? poor fair average good excellent

Students Name
Handout Sheet #1

Date
Aptitude Log

Aptitude Log

	Part Done Well	Part Done Poorly
School Subjects		
Jobs held		
Hobbies		
Extra-Curricular (Clubs) (Organizations)		
Leisure time Activities		

Aptitudes References

1. Billet, R.O. and Yeo, J.W. Growing Up. Boston: D.C. Heath & Company, 1958.
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7. Planning My Future. Chicago: National Forum, 1956.

VISUAL AIDS:

1. Choosing Your Occupation (Coronet)
2. Finding The Right Job (Coronet)
3. Finding Your Life Work (Carl F. Mahnke Productions)
4. How To Investigate Vocations (Coronet)

Needs and Motivations

I. Objectives

1. Realization that all behavior is motivated.
2. To demonstrate the relationship between needs and motivation.
3. Examine some of the basic needs all men possess.
4. Stimulate student exploration of their individual needs and motivations.
5. Student investigation of occupational opportunities based on their needs.

II. The Nature of Needs

A. Primary Needs
   1. All men have the same needs.
      a. food
      b. clothing
      c. shelter

   2. Men differ in their satisfaction of needs.
      a. Some people like Italian food.
      b. Some people like ranch homes.
      c. Some people like Chinese food.
      d. Some people like split level homes.

B. Restrictions on satisfaction of needs
   1. Social Demands
      a. People are expected to eat with forks and spoons.
      b. Men are expected to remove hats in public buildings.
      c. Men are expected to serve their country.

   2. Legal Demands
      a. Persons under 21 are forbidden to drink liquor.
      b. An individual wants a sports jacket but he can not break into a store and take one.

C. Summary
   1. All men have basic needs.
   2. These needs can be satisfied in a variety of manners.
   3. Society has placed social and legal limits on the satisfaction of needs.

III. Divisions of Needs
   A. Organic needs or drives
      1. Needs of the body
      2. Types of Needs
         a. warmth
         b. cold
         c. pain
         d. thirst
         e. hunger
         f. sleep
         g. sex

B. General drives
  1. Many activities can't be explained in terms of bodily needs.
    a. reading the newspaper
    b. painting
    c. listening to the radio
    d. skiing
    e. (etc.)

  2. Types of general drives which might lead to the above activities
    a. curiosity
    b. interest
    c. pleasure
    d. adventure
    e. fear

C. Social Needs and Drives
  1. Much behavior is motivated in quest of satisfying social goals.
  2. Types of social needs or drives :
    a. social approval
    b. success
    c. to be like others
    d. status
    e. security
    f. power
    g. money
    h. independence
    i. service to others
    j. pride
    k. love

IV. Further Exploration of Social and Personal Needs

A. Social Approval
  1. Recognition by others
  2. Praise
    a. makes one feel important
    b. gives one a sense of worth
  3. One will be impelled to work harder at something when given credit.

B. Success
  1. Feeling of accomplishment
  2. We enjoy doing those things we do best
    a. brings self satisfaction
    b. gives one a feeling of accomplishment
  3. We enjoy partaking in those activities where we achieve our goal.

C. To Be Like Others
  1. Most people try to conform.
    a. gives them a feeling of security
    b. makes people feel comfortable

  2. Individuals engage in activities which are condoned by the group.
    a. dress
    b. drinking
    c. smoking

D. Status

  1. Position or rank to which a person belongs
  2. Factors affecting status
    a. group to which one belongs
    b. desires of the individual
  3. Why do people strive for status?
    a. live in a certain way
    b. earn a certain amount of money
    c. to be treated in a certain way
    d. to be important
  4. Symbols of adolescent status
    a. car
    b. clubs
    c. clothes
    d. ability to date
    e. athletics
    f. physique
    g. strength
  5. People strive to reach certain positions in life. Attainment of these positions will carry with them honors, rewards, priveleges.

E. Security
  1. Being able to hold on to what one has
  2. Being positive that ones needs will be satisfied
  3. Fear of losing security is a strong source of motivation.
    a. losing ones status
    b. losing ones money
    c. losing ones power
    d. losing ones job

F. Power

  1. Some people are driven to control mastery over
    a. people
    b. situations
    c. machines

  2. The occupation becomes an outlet for this need of power.

G. Money

1. Used only as a medium of exchange
2. Not valuable in and of itself
3. Ones needs will determine how much money one must have
4. Money is important to the extent it can satisfy ones needs.
5. Money has social significance
    a. can be a symbol of success
    b. can be a symbol of power
    c. can be a symbol of status

H. Independence

1. Desire to make ones own decisions
2. Dissatisfied with being supervised by others
3. Seeking self expression

I. Service To Others

1. Desire to help others
2. Greatest satisfaction comes from giving of oneself
    a. nurses
    b. clergy
    c. social worker

J. Pride

1. An opinion of oneself
2. Pride of oneself
    a. dignity
    b. self respect

K. Love

1. We try to please others
2. Parents provide for their families
3. Occupations
    a. means of providing things and opportunities for loved ones
    b. may choose an occupation wiich gives one more time to be with loved ones

V. The Nature of Motivation

One man wants to be a clergyman while another strives for election as a political leader. A young boy can hardly wait for the day he is 17 and old enough to enlist for armed services. It is after 1 A.M. When John and Al leave their dates off and head to Gray's Restaurant.

All of these examples depict individuals in various states of need. Can you identify the basic needs which may be illustrated?

1. service to others
2. power
3. independence
4. hunger

A. Define Motivation

1. Behavior which is started by needs and directed toward goals.
2. Some condition which directs a person toward a goal.
3. (Student Definition).

B. How is a person motivated?

1. We all have needs which must be satisfied.
2. Unsatisfied needs cause disturbances.
   - a. tension
   - b. frustration
   - c. irritation
   - d. unhappiness
3. People seek to alleviate these unsatisfied needs. (MOTIVATION)
   - a. A person who has hunger pangs (tensions) is motivated to seek food.
   - b. A person who is unhappy at his occupation may be motivated to seek a new job.

C. Are people always aware of their motivations?

1. People are motivated by things they are unaware of.
2. Persons sometimes repress painful experience.
   - a. situations that are embarrassing
   - b. things one is ashemed of
   - c. experience in which guilt was involved

VI. Occupations are related to ones needs and motives.

A. Occupations enable individuals to satisfy their needs
1. organic needs and drives
2. general drives
3. social needs and drives

B. How can occupations satisfy needs
1. Indirect satisfaction of needs
   a. Salary satisfies needs

	NEED
(1) purchase an automobile	status
(2) purchase clothing	belong to a group
(3) spend a weekend at the shore	independence
(4) by hunting equipment	power

2. Direct Means of satisfaction
   a. The job itself satisfy needs

	NEED
(1) policeman	power
(2) truck driver	independence
(3) doctor	status
(4) mechanic	curiosity

C. Money as a sole means of satisfaction
   1. Insufficient if needs aren't satisfied
   2. Can lead to frustration, unhappy
   3. Give examples of needs that can not be satisfied by money
      a. self respect
      b. prestige
      c. acceptance by others
   4. List men whose prime motivation was not money
      a. Pope Paul
      b. Walter Shirra
      c. Arnold Palmer
      d. Governor Rockerfellow
      e. General Eisenhower
      f. Martin Luther King

D. An occupation may satisfy many needs
   1. Teacher
      a. security
      b. prestige
      c. service to others
      d. authority

   2. Mechanic
      a. independence
      b. money
      c. curiosity

Unit on Needs and Motivations

Suggested Activities and Projects

1. Students will investigate money as a primary means of job satisfaction. Students will interview five adults and secure their opinions. Those who are being interviewed will be asked what factors they would investigate when searching for a new job. The class will tally the results in a frequency distribution.

2. Students will investigate values. Students will interview three adults in an attempt to determine the possessions they value most. Students will also compute the possessions they value most. A committee will compile and rank both student and adult possessions which they value most.

3. Discontentment or unhappiness may arise from an unsatisfied need. Do you think discontentment is good or bad for an individual? How may discontentment be a disadvantage or at times an advantage? Give specific examples.

4. Do you know of anyone who has as much wealth or more than your family yet is discontented? Since this person is financially secure how can you explain his discontentment?

5. Read the biography of an individual in whose footsteps you would like to follow. From this reading be prepared to discuss those factors which motivated the individual in his quest for success.

6. Have students make a list of the ten most desirable jobs. Upon finishing this task they should make a list of the ten least desirable jobs. Committees will then rank both groups of jobs in order of their frequency. The students should try to determine the following:

- a. What do the most desirable jobs seem to have in common?
- b. What do the least liked jobs seem to have in common?
- c. Is salary always a factor of the most desirable jobs?
- d. What might explain the fact that some of the most desirable jobs are not the best paying jobs?

7. Group Activity

The class is to be divided into groups which will role play various social needs. The teacher will assign role playing situations based on the following social needs.

- a. social approval
- b. success
- c. to be like others
- d. status
- e. security
- f. power
- g. money
- h. independence
- i. service to others
- j. pride
- k. love

These social needs will be role played in work, social and school situations.

8. Do all people entering the same occupation have similar needs, abilities and interests? Each group will investigate this question and report to the class.

Each group will interview five persons who are employed in the same occupation. As an example the five individuals may all be employed as bus drivers.

Suggested questions for this type of interview are as follows:

Interest	1. What are your interests?
Abilities	2. What abilities do you consider necessary for this job?
Satisfaction of Needs	3. What do you like about this job?
Lack of Need Satisfaction	4. What don't you like about this job?

A. Case Study

Mr. Jackson came to this country when a boy and learned to be a weaver in a mill. The only schooling he ever had was limited to the elementary grades and evening classes. One son, however, graduated from college, another from a fine trade school; and a daughter is a teacher. All are doing well, have married, and have families. Mr. Jackson has a small mortgage on his home, which will be clear in a few years. Outside of the shop where he is employed, his church, and his immediate neighborhood, he is practically unknown to the other citizens of the town. He has taken an active interest in his children's problems, and when they were small he played with them whenever he could.

Dr. Smith is an eminent physician, well-to-do financially, and the father of two daughters and a son. He is president of a national association of doctors, president of the local chamber of commerce, and a leader in several fraternal organizations. His professional, civic, and social obligations have demanded so much of his time that it has been impossible for him to spend much time with his family. His son has been out of high school for three years but has never worked regularly. One daughter has left home to live in the city because she cannot get along with her parents; the other is having a difficult time in getting through high school because of competing social interests.

B. Issues Involved

1. Which man would you rather be at 60? Why?

2. How much of the success of a man or a woman depends upon the success of his children?

3. Will this be true of your parents? Can they be successful without your help?

4. What kind of success does a normal boy or girl desire? Do standards of success differ in different communities? Is anyone as much as a success as he would like to be?

5. Do the elements of success vary in different centuries and in different communities? What are some of them? What can you do now to increase your own chance of success? Have you ever read "The Assessor Success," in The Trimmed Lamp, by O. Henry?

6. What part does money play in success? Education? Social position? Business, industrial, or professional leadership? The respect of your neighbors? Service to the community? A happy home and family life?

C. Summary of the travel and conclusions

The class is usually surprised at its own choice of the more successful man. The idea that the success of their parents depends largely on them also is a surprise. The importance of the human elements is gradually given greater recognition. Character, service, family are generally agreed to be the foundation of success--the rest is desirable but not essential. Very few pupils in school will claim that they have ever given this problem much thought. Most have accepted superficial standards such as money, position, elective office, etc.

Allen, R.E. Case Conference Problems in Group Guidance. New York: Inor Publishing Company, 1933.

Students Name
Handout Sheet #1

Date
Case Study

Example--The Embarrassed Driver

Joe had his license for a week and felt as though he had it made. After all, he had waited until he was 17 even though some of his buddies were driving on the sneak at 15 and 16.

It was a Saturday night when three couples decided to drive to Seaside. Joe felt 10 feet tall as he opened up his car. Suddenly Joe hit a telephone pole as his attention had shifted toward his date. He had taken his eye off the road for only a split second.

Fortunately, no one was hurt in the accident. After realizing that no serious damage had taken place, the group began to make fun of Joe's driving techniques. The pride which Joe had felt was now completely lost as he was overwhelmed by embarrassment.

As the months passed by, Joe had completely forgotten about this incident. Such an experience was too painful to remember and striking it from his conscious memory was a way in which Joe handled the problem. At the same time it was quite noticeable that Joe had taken a dislike toward driving. When questioned about this diskike Joe was heard to say "there are too many cars and maniacs on the road."

Your reactions to the Embarrassed Driver.

1. What factors motivated Joe to drive his car to Seaside? Have you been involved in a situation similar to this? What motivated you?

2. Do you feel the group was really trying to hurt Joe with their criticisms? Have you been involved in a situation where the group ridiculed or criticized an individual? How did the individual react?

3. Joe was quoted as saying "there are too many cars and maniacs on the road". Do you think this was valid reasoning on his part? Be prepared to explain.

4. If you were in Joe's poiition how would you have handled the situation?

5. Can you think of any situation which has been completely forgotten by a friend. What were the circumstances surrounding the situation? Why have you remembered the situation while your friend has forgotten it?

Students Name
Handout Sheet #2

Date
Job Satisfiers

Type of Jobs	Needs which it satisfies
1. truck driver	
2. postman	
3. draftsman	
4. mechanic	
5. lawyer	
6. teacher	
7. merchant	
8. salesman	
9. electrician	
10. presser	
11. machinist	
12. commerical artist	
13. policeman	
14. social worker	
15. beautician	

Some of these jobs may satisfy various needs. Students are to list as many satisfiers as they can.

Needs and Motivations References

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Unit on Attitudes

I. Objectives

1. Make students aware that attitudes motivate their behavior.
2. Many attitudes are formed during childhood.
3. Since many attitudes are unconsciously formed we should continue to evaluate their validity.
4. Understand how attitudes may be formed.
5. Realize that changing attitudes is a difficult task.

II. Definition of attitudes and beliefs

- A. Define attitudes
  1. Positive (favorable) or negative (unfavorable) response.
  2. Reactions to objects, person, situations.
- B. Effect of attitudes
  1. Persons react in accordance to attitudes.
  2. Favorable attitudes enable persons to be happy, contented, successful.
  3. Unfavorable attitudes can lead to frustration, resentment, failure.
- C. Define belief
  1. Acceptance or rejection of a statement or proposition.
  2. Held without strong emotional feelings toward or against something.
     - a. (example) I believe it will be warm tomorrow.
     - b. (example) I believe school begins on September 7.

III. Development of attitudes and beliefs

- A. Cultural Factors
  1. Define Culture
     - a. customs and traditions of a people.
     - b. beliefs and attitudes toward important aspects of life.
  2. Transfer of Culture
     - a. radio, T.V., newspapers
     - b. school
     - c. Philosophy on which nation was developed

B. Family Influence
  1. Assimilation of parental attitudes
    a. Parental teachings
    b. Child identification with parental attitudes
  2. Psychological Studies
    a. Measurement of parental-child attitudes
    b. Results have confirmed a direct relationship
      1. (example) Most individuals belong to the same political party of their parents.
      2. (example) Most individuals espouse the same religion as their parents.

C. Peer Group Influences
  1. Definitions
    a. Peer-a person of the same rank
    b. Group-two or more persons
      1. Whose behavior is interdependent
      2. Sharing common beliefs, values, norms
  2. Groups become important
    a. Adolescent moves from a state of dependency to independenc
    b. Adolescent relies more on group than parents
      1. Seeks group's companionship and entertainment
      2. Needs emotional and social support
  3. Strict adherence to group norms
    a. Belief peer opinions and actions probably correct
    b. Fear of being ousted from the group

D. Information influences attitudes
  1. How one acquires information
    a. Beliefs and opinions sometimes based on half truths
    b. Prejudiced attitudes based on insufficient and inaccurate information.
  2. Fallacious reasoning
    a. Jane is a blond
    b. Jane is dumb
    c. Therefore all blonds are dumb

RESULT: The use of reasoning based on partial truth has led to an inaccurate generalization.

E. Authorities influence attitudes
  1. People rely on authorities
    a. Do not have access to facts
    b. Unable to formulate beliefs from information
      (1)example- The President says we need anti ballistic missles.

2. Limitations of Authorities
   a. Disagreement among authorities
   b. Authorities have self interests, biases, and needs which affect their outlook.
   c. Authorities sometimes speak on issues outside their competence.

Suggested Activities and Projects for Unit On Attitudes

Note: These activities and projects were designed to supplement the preceding discussion areas

1. What are some of the various peer groups you belong to? What are the attitudes and beliefs which these groups espouse. Why might another person want to join your group?

2. Upon viewing T.V. and listening to radio you will notice that many of the commercials and advertisements are designed to make your beliefs and attitudes sympathetic toward their cause.

State at least 4 techniques which are attempted in an effort to change your attitudes or beliefs.

Note: This activity may be used to reinforce the English unit on Methods of Propaganda.

3. One of the chief aims of education, government, business, religion, etc. is to emphasize and encourage positive attitudes. The successful salesman, clergyman, teacher, and politician can influence your attitudes and beliefs.

How would you go about changing the attitude or belief of someone else. Write some of the methods you would employ.

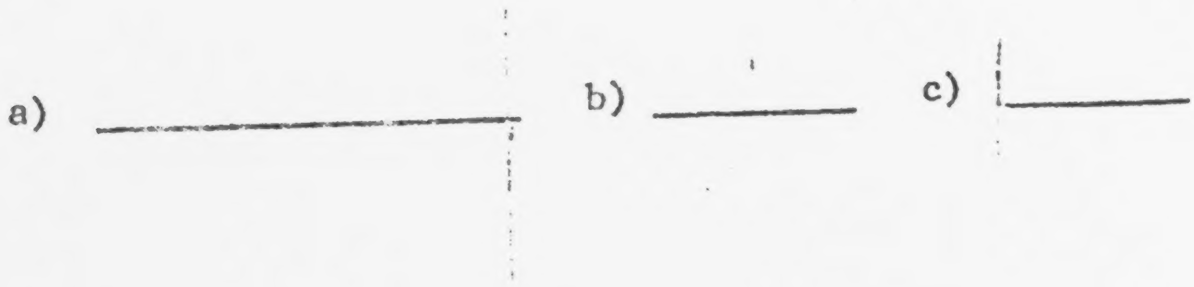
(GROUP WORK) Divide the class into groups of 5. Three members will attempt to change the attitude of two members. The group will then report on its success or failure. If there was no change in attitude the group should be prepared to tell the class the methods they employed, why they failed and what they might have attempted.

4. Divide the class into groups of five (GROUP WORK). Each group will illustrate why total reliance on authorities should be limited. From magazines, radio, T.V. books, etc. they are to point out how some authorities in American life:

1. disagree among themselves
2. illustrate attitudes which reflect self interests, biases and needs
3. speak on issues outside their competence

5. Illustrate the effect of peer groups influence. All students in the group will give the same wrong answer to this problem. One person will know nothing of the group's plan to give this answer.

Question: Which "T" is largest



The group will respond to b as the correct answer. If the experimental subject agrees with the group, he will then be asked?

1. How did you feel?
2. Why did you give b as your response?

HAND OUT ACTIVITIES

NOTE: It is suggested that these hand out sheet be distributed to all students. They can be used for reinforcing and clarifying the discussion unit on attitudes and beliefs.

Date

Students Name
Hand Out Sheet No. 1 (Attitude Checklist)

Attitudes once formed can become a powerful influence in the behavior of a person.

Directions Rate yourself on the following categories. Give yourself a 1 on those items you feel strongly for and a 5 for those items you feel strongly against. If you are neutral rate yourself a 3.

Hand Out Sheet

__________ Industrial Prep Program

__________ homework

__________ teachers

__________ girls

__________ draft

__________ driving age at 21

__________ College Prep Program

__________ welfare

__________ Indianapolis 500

__________ Metropolitan Opera

Think for a moment about those items which you assigned a 5. As you read these items did you feel a dislike for them? Did you use a little extra effort and force in marking the 5 so that it is blacker that the other ratings? Did your expression change as you read the item?

These are but some of the reactions which may have been evoked from the concepts which you oppose. These emotional responses on your part indicate that you will react strongly toward similar items if they occur in the future.

Date

Students Name
Hand Out Sheet No.2

Parental Beliefs and Attitudes

Directions: Make a list of parental beliefs and attitudes. Be prepared to criticize the ones you disagree with and defend those you are in accord with.

Check those you accept and those you reject.

	ACCEPT	REJECT
example (1) One should attend church every week.	***	
example (2) People should not drink.	***	
example (3) Everyone should go to college.		***

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Students Name
Hand Out Sheet No.3

Date
Attitude Questionnaire

All of us have developed certain beliefs and attitudes toward life.

Directions: You are to list 5 beliefs or attitudes which you hold toward school, work, and home.

A. Beliefs or attitudes toward school

1.

2.

3.

4.

5.

B. Beliefs or attitudes toward work

1.

2.

3.

4.

5.

C. Beliefs or attitudes toward home

1.

2.

3.

4.

5.

Attitude References

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UNIT ON PREJUDICE

I. Objectives

1. Understand that all prejudices are learned.
2. Many prejudiced individuals are unaware of their biases.
3. Prejudices are sustained because they fulfill frustrated needs.
4. To encourage student evaluation of their attitudes and prejudice.

II. Where do Prejudice Begin

A. Define Prejudice

1. Pre-judgement of dislike
2. Based on knowledge of a race rather than of the individuals
3. Stereotyping of individuals
   - a. (example) All Italians who were ever born were winos.
   - b. (example) All Scotchman who were ever born were stingy.

B. Prejudices are learned

1. No one is born with prejudice
2. Correlation between prejudice of children and their parents
3. Small children show no race prejudice

C. Where are prejudices taught?

1. parents
2. peers
3. teachers
4. mass media
   - a. newspapers
   - b. T.V.
   - c. radio
   - d. books
   - e. magazines

D. How are prejudices taught?

1. contact with the prejudiced group
2. contact with people who are prejudiced
   - a. Many people have formed prejudice against minority groups even though there has been no contact.
   - b. (Fortune Survey) Strongest resentment against Catholics and Jews where their numbers were fewest. (Fortune Vol.36 Oct. 1947)

E. Prejudice is an attitude

1. Strong negative feeling of hostility
2. Directed at various groups

   a. Racial
      (a) Negro
      (b) Chinese

   b. Religions
      (1) Catholics
      (2) Jews
      (3) Moslem

   c. Vocational
      (1) Politicians
      (2) Police

F. Lessening of Prejudice

1. Awareness of prejudice
2. Contact of prejudiced with group they are biased toward

   a.) Measurement of white soldiers after serving in intergrated unit
   b.) Amount of prejudice drastically reduced

G. Stages of Prejudice

1. Child learns a group is bad.
2. As he grows he learns more specific things about the group.
3. He generalizes and attributes these "bad things" to the entire group.

III. Why are Prejudices sustained

A. Satisfies frustrated needs

1. Need for status and importance
2. Artificial ranking makes individuals superior
3. Poor, uneducated, unimportant persons become superior to prejudiced group

B. Outlet for aggression

1. Hostility and aggression originate when a person is frustrated

   a. blocked in ones goal
   b. unable to succeed

2. Hostility and aggression cannot always be taken out on source of frustration

        a. Substituted toward an "inferior group"
        b. (example) Lieutenant chews our sargeant who chews our private who kicks dog.

C. Scapegoating

    1. Blame others for your misfortune
    2. Common among those who suffer from political, economic or social frustration.

        a.) Hitler blamed Jews for Germans economic and social problems in 1930's.
        b.) Christians were persecuted by Roman Emperor Nero.

D. Perception and judgement

    1. Define perception

        a.) that which you are aware of
        b.) your attitudes, beliefs, values and needs affect your perception

    2. Prejudice affects ones perception

        a.) (example) Belief that Mexicans are dirty and ignorant.
        b.) (example) Individual will be especially aware of dirty and ignorant Mexicans
        c.) (example) The individual will not be aware of intelligent clean Mexicans

E. Fear and ignorance

    1. People become anxious of that which is unknown, different.
    2. Many superstitions arise concerning these groups.

IV. What can be done to overcome prejudices

A. Group Action

    1. Fostering education and learning so as to understand the other group.
    2. Work in groups which are different than yours.
    3. Work for legislation to protect all groups in the society.
    4. Seek improved economic and social conditions for all.

B. Individual Action

1. Examine your own thoughts to determine prejudices?
2. Ask - How was this prejudice or attitude acquired?
3. Is this prejudice based on fact and contact or myth and heresay?
4. Make an effort to obtain first hand information through contact with the minority group.
5. Judge all people as individuals rather than as a group entity.

Unit on Prejudice

Suggested Activities and Projects

1. Group Work-Each group will be composed of five students who will construct a definition of prejudice. The group will also try to determine the characteristics of people who appear to be prejudice.
2. Students are assigned to read a local newspaper or magazine. They are to locate five examples which in their opinion exemplifies prejudice. These articles will be brought to class for inspection and discussion.
3. Is there any real difference between physical and mental cruelty? Why is it that some people who would not strike or injure a disabled person would be cruel to persons who are different? Is ignorance of the nature and extent of mental cruelty any excuse for it?
4. Group Work- (Groups of five) What are some of the techniques people use in an effort to disguise their prejudices? Are all prejudices easily observable and open to recognition? What are some subtle forms of prejudice which you have observed?
5. The class will be presented with an ambiguous picture. A scene will depict two boys who seem to be running away from a burglarized store. One boy will be white and one boy will be negro. The picture will be flashed for a very short time for class observation.
   The students will be asked to report on the situation seen in the picture. The teacher's questioning will be designed to elicit what has occured and who is involved. The students will try to explain why they chose the answers they did.

6. A mock fight scene will be started in class. One individual involved will be a student who has been in constant trouble which includes fighting. The other individual will be a student who is quiet and well respected. The quiet student will be instructed to begin the fight.
Students observations of the situation will be surveyed. The students will be questioned as to what occured, who was at fault, and why it occurred?

Students Name — Date
Hand Out Sheet #1 — Opinion Quiz

True and False opinion quiz

_____1. Frenchmen are more immoral than Americans.

_____2. A Catholic cannot be a good American because, when it comes to a show down he will obey the Pope rather than the President.

_____3. All Negroes are musical.

_____4. Jews are notorious international bankers.

_____5. Most Jews are Communists.

_____6. Scotchman are stingier than Americans.

_____7. Relatively more crimes are committed by foreigners than by native born Americans.

_____8. Atheists are not governed by allegiance to any code of ethics.

_____9. All Orientals are deceitful, cunning, and unscrupulous.

_____10. All Italians are winos.

_____11. Men can reason better than women.

_____12. Blondes are more fickle than brunettes.

_____13. Americans have a better sense of humor than Englishmen.

_____14. Members of the white race are born with better brains than members of any other race.

Each student is given a copy of the above true and false opinion quiz. He is to mark T to the left of those answers which are true and F to the left of those answers which are false. All of the above answers are unquestionably false.

Students Name
Handout Sheet #2

Date
Character Quiz

This is a character quiz which is designed to explore your beliefs of various groups.

You are to rank each group in terms of the following system.

0	3	5
small amount	average	large amount

	Russians	Germans	Italians	Negroes	Puerto Ricans	Poles	Chinese	Protestants	Jews	Catholic
honesty										
neatness										
ambition										
respect										
responsible										
co-operative										
friendly										
courtesy										
humor										
patience										

TOTAL

Students Name
Handout Sheet #3

Date
Contributions of Immigrants

	Name	Country	Field of Work
1.	Andretti	Italy	Race Driver
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

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VISUAL AIDS:

1. Our Basic Civil Rights (Coronet)
2. Who Are The People Of America? (Coronet)

FACING AND RESOLVING PROBLEMS UNIT

I. Objectives

1. Realization that adjustment is predicated on facing and solving problems.
2. Investigate common problems faced by adolescents.
3. Examine evasive methods of problem solving.
4. Examine various methods of investigating and solving problems.

II. Problems

A. Define problem
   1. Question proposed for solution
   2. A perplexing question concerning
      a. situation
      b. person

Summary - All people have problems since they are constantly faced with questions that must be answered or solved.

B. Satisfaction of Needs.
   1. All persons strive to satisfy their needs.
      a. organic drives or needs
      b. general drives
      c. social drives or needs

   2. Inability to satisfy needs
      a. feeling of insecurity
      b. restlessness
      c. anxiety
      d. tension
      e. depression

III. Interference with the Satisfaction of Needs

A. Personal Factors
   1. Something about the person himself
      a. limited intelligence
      b. poor co-ordination
      c. bad temper
      d. nervousness
      e. lack of confidence
      f. poor vision
      g. poor hearing
      h. overweight
      i. physical defects
      j. etc.

   2. A combination of these factors may deter an individual from satisfaction of
      a. social drives
      b. organic drives
      c. general drives

B. Environmental Factors

1. Something in the surroundings or environment
    a. lack of money
    b. peer group
    c. city where one dwells
    d. high school
    e. types of academic courses
    f. extra curricular activities
    g. job opportunities
    h. types of specialized training
    i. etc.

2. A combination of these factors may deter on individual from satisfaction of
    a. social drives
    b. organic drives
    c. general drives

C. Conflicting Motives

1. An individual wants to satisfy two needs.
2. A decision must be made between two alternatives.
3. Problem Situation:
   Joe is a member of the football team and is in training for the upcoming championship game. He has been invited to a late party but realizes he cannot keep training and still accept the invitation. Here is a conflict between two desires which is just as much an obstacle as are the personal and environmental factors.

IV. Solving Problems Vs. Evading Problems

A. How are people motivated to solve problems?

1. Lack of satisfaction of need on problem brings tensions.
2. Individuals are motivated to activity in an effort to solve their problem.

B. Meeting Problems Means Activity

1. Individuals will react differently to the same need or problem.
2. Problem Situation:
   Three individuals have a desire for status and prestige.
    a. Joe seeks it by drinking.
    b. John finds it through participation on the basketball team.
    c. Al finds it be racing his car at the drags.
3. Individuals rely on methods which were successful in the past.
    a. John became ill when he had to speak in front of the class.
    b. John becomes ill at work when it is his turn to give a progress report.

V. Defense Mechanisms

A. What are they?
   1. Unconscious methods of behaving
   2. They allow us to cope with anxiety or reduce tension.

B. How are they formed?
   1. Needs arouse tensions and anxieties in individuals.
   2. Individual is motivated.
      a. solve the problem
      b. reduce anxiety and tension
   3. Inability to face the problem
      a. use of defense mechanisms
      b. avoids problem
      c. reduces anxieties
   4. Example of a defensive mechanism to avoid a problem.

Tension may be relieved by an activity which is really an evasion of the existing problem. John had a tendency to complain that a job requirement was unfair or getting someone else to do the job. In this way John could not hope to achieve any amount of success. John was able to evade the problem and was relieved of the tension which lack of success aroused.

VI. Evading Problems Through Defense Mechanisms

A. Rationalization
   1. Justification
      a. thinking
      b. feeling
      c. acting

   2. Unconscious Process
      a. a process one is unaware of
      b. a lie or excuse for ones behavior

   3. Purpose
      a. helps to explain why you didn't do something
      b. helps to explain why you needn't do something

Major purpose

They defend a person from examining the real reasons of his behavior which are painful.

   4. Examples of Rationalization
      a. I would have gotten an A in class but the teacher has it in for me.
         The individual probably didn't deserve the A but that was the excuse he gave himself.
      b. Tom would have made the team if he didn't have to work.
         Tom was not capable of making the team and used his work as an excuse.

B. Projection

  1. Unconscious Process
  2. Ascribe to others ones own undesirable attitude.
  3. Helps individual defend against their own weaknesses.
  4. Examples of projection
     a. If a person has a tendency to be cruel to people yet knows this is wrong, he may accuse other people of being cruel.
     b. A person may have a tendency to cheat on a test and may defend himself by saying that others cheat.

C. Daydreams
  1. Substitutes for reality and accomplishment
  2. Method of escaping real life
  3. Examples of daydreaming
     a. Bill was a big boy who had a good physique. He would often daydream of daring exploits on the football team. This became a substitute for actually playing.
     b. Al often daydreamed that he was a great singer and was widely admired and praised.

D. Repression
  1. A person forgets
     a. things which make him anxious
     b. things which make him uncomfortable

  2. Convenient way to avoid problems
  3. Examples of repression
     a. I can forget the dentist appointment because I am anxious about the drill.
     b. The individual who forgets to bring his report card home relieves the anxiety which would come from parental dissapproval.

E. Displacement or Substitution
  1. Method of transferring hostility
     a. from ideas and person
     b. to other ideas and persons
  2. Why do persons use displacement?
     a. inability to take out hostility one ones boss
     b. situation beyond ones control
  3. Examples of displacement
     a. Your father has had a hard day at the office and takes it out on you even though you haven't irrated him.
     b. Mickey Mantle strikes out and throws his helmet. He has displaced his frustration and hostility onto the helmet.

F. Regression
  1. Return to a early or primitive form of behavior
  2. Childish reactions
     a. crying
     b. pouting
     c. tantrums
     d. anger

3. Examples of Regression
   a. John is inducted into the service but is continually homesick. His thoughts revert back to those satisfying situations which occured at home.
   b. A person who goes to bed with the slightest cold may be regressing to behavior which, in childhood brought him affection and attention.

G. Compensation
1. Individual inadequacy
   a. weakness
   b. undesirable trait
2. Reaction of individual
   a. development of an asset
   b. substitute this asset to compensate for a weakness
3. Examples of compensation:
   a. An individual who isn't successful in school tries to be successful in athletics.
   b. John is not very popular and tries to compensate for this weakness by driving his school mates to school.
   c. Sam was the samllest boy in the gang. However, he became the most daring and criminal in order to achieve status among the older boys.

H. Temper
1. Frustration of a need
   a. individuals become angry
   b. individuals become quarrelsome
2. Temper
   a. reduce tension
   b. do not resolve the problem
3. Examples of using ones temper:
   a. John is unable to finish his part of the group problem. He grows intolerant, becomes angry and loses his temper.
   b. Al is caught looking at a 3rd strike. He vehemently condems the umpire during a fit of anger.

I. Bragging
1. Is a means of covering up ones weakness.
2. Enables a person to think more highly of himself,
3. Draws attention to a person
4. Examples of bragging:
   a. John is continually bragging about his ability to handle his car. He has never really been successful but finds the attention rewarding.
   b. Jim continually brags about his explorts as a lady's man.

J. Clowning
1. Used to attract attention
2. Used as a substitute
a. feel successful
b. be important
c. for recognition

3. Covers ones inadequacies
a. enables the person to seem witty and clever
b. makes a person feel superior since others are the brunt of his jokes

4. Examples of clowning
a. Al made John the brunt of his jokes and thus felt superior.
b. Jim would constantly clown around while bowling. People didn't really notice his lack of skill due to his constant clowning.

K. Bullying
1. Used to attract attention
2. Used to build up self-sufficiency
a. individual feels insecure
b. individual feels inadequate
3. Gives one a feeling of
a. power
b. authority
c. status
4. Examples of bullying:
a. Jeff was a poor student and resented being at the bottom of the class. He began to push students around as his scholostic achievements began to drop. He gained a sense of importance from these tactics.
b. John developed into a bully when he found that he gained great respect from other students.

L. Illness (psychological cause)
1. Aids a person in escaping from his real problems.
2. Imagined illness
a. Medical exams indicates there is nothing physically wrong.
b. People suffer from headaches, backaches, upset stomaches, etc.
3. Why do people become ill?
a. avoids distasteful situations
b. brings sympathy and attention
c. helps them avoid responsibility
4. Examples of illness:
a. Each time Jack is on the verge of ending his dating relationship with Sue she suddenly develops headaches. Jack becomes more attentive and sympathetic toward Sue.
b. Jack suddenly becomes ill when he knows it is his turn to climb the high scaffold at work.

VII. Six Step Attack on Problems

- A. State your problem clearly.
  - 1. What is it you want to accomplish?
  - 2. Write the main problem.
  - 3. State it in specific terms.
- B. List the obstacles that keep you from solving this problem.
  - 1. Problems arise when obstacles stand in the way of ones goals.
  - 2. Obstacles
    - a. personal - something about the person interferes with attaining the desired goal
    - b. environmental - something in the environment interferes with attaining the desired goal
    - c. realize ones limitations in relation to realistic goals
      - (1) ability
      - (2) interest
      - (3) intelligence
- C. List the assets you have to work with in solving this problem.
  - 1. Use the experience and knowledge of others.
  - 2. Think of abilities and skills you used in the past.
- D. List some possible solutions.
  - 1. Problems may be attacked from various perspectives.
  - 2. The more solutions one can devise the better the chance of finding the best solution.
- E. Try to forecast the results of each of these solutions.
  - 1. Try to imagine what the solution would be like.
  - 2. Try to get evidence on the proposed solution.
  - 3. The solution should be based on realistic needs.
- F. What is the best solution for me?
  - 1. Does it give you what you want?
  - 2. If others are involved, is your solution fair to them?
  - 3. Do your friends and family approve of your solutions

VIII. How does one obtain help for a problem?

- A. Need for additional help
  - 1. If you still feel troubled and can not locate the problem.
  - 2. If you try to retreat from the problem.
  - 3. If the problem continues to evoke anger and distress
  - 4. If you continually blame others for your problem.
  - 5. If you are unable to list your resources which can aid you in solving the problem.
  - 6. If your solutions are unrealistic.
  - 7. If you are dissatisfied with your proposed solutions
  - 8. If continuing time brings you no closer to a solution.

B. Where to get help
    1. Your family
    2. Your counselor
    3. Your teachers
    4. Your friends
    5. Your minister
    6. Understanding adult
    7. Family doctor

C. Get as much information as possible.

    1. Read books and pamphlets that give problem solving information and advice.
        a. Many problems are not unique.
        b. Reading can give you ideas of how others solved similar problems.

    2. Talk your problem over with your friends and classmates.
        a. Discussions can stimulate you to new ideas.
        b. Additional information may lead to solving the problem.

    3. Talk over your problems with an understanding adult.
        a. leads to new insights
        b. Use an older person's experience to facilitate solving the problem.

    4. Help yourself.
        a. You must be ready to act upon the problem.
        b. The final decision is yours.

D. You and your work

    1. Survey those fields in which you already have great interest.
    2. Study yourself to see whether you have abilities that would be particular assets in a particular job field.
    3. Evaluate the opportunity for advancement the field offers.
    4. Determine how the job will contribute to your general needs.

Unit on Problem Solving

Suggested Activities and Projects

1. Do you think it is wise for people to avoid situations where problems might arise? From your observations what are the characteristics people display when they are experiencing difficult problems?

2. Do well adjusted people seem to have any similarities in the way they handle problems? You are to interview three persons who you respect a great deal and who seem to be well adjusted. Ask these persons how they go about meeting problems which arise. Try to write down their plan of attack. What similarities do you see in their approach?

3. Self adjustment is a neeessary quality of good mental health. What seem to be the characteristics of the well adjusted person? What are those of the poorly adjusted person?

4. Administer the S.R.A. Youth Inventory or a similar such test. The results of each individual will be kept anonymous. The general results will be plotted in a frequency distribution.

5. From the results of the inventory the most recurring problems will be identified. Students will role play these problem situations before the class. All individuals in the class will try to decide how the problem could be handled.

6. Panel discussions will be used to discuss some of the common problems extracted from the S.R.A. inventory. Both parties in the problem will be represented on the panel. If their is a student parent conflict then the panel will consist of individuals representing the views of both students and parents.

7. This activity will consist of tape recording sessions. Students will role play situations involving the use of defense mechanisms. Students will be asked to identify the types of defence mechanisms which are being broadcast.

8. On the job interviews will be used to illustrate that something regarded as a problem to one person may actually be regarded as a challenging part of a job to another person. The student will interview five persons in the type of occupation he would some day like to enter.

Students will ask the workers to discuss the major problems in the job and how to overcome them. They will also seek to uncover information concerning the advantages and disadvantages of the job. Their comparisons will be reported to the entire class.

9. All students will be asked to use the 6 step attack on solving problems. The teacher will select common problems faced by the group. The class will be divided into groups and will outline a tentative solution to the problem by using the 6 step attack. The groups will then compare their solutions for discussion and evaluation.

Example of the 6 Step Attack on Problems

I. Problem: I want to get to use the family car more often and with
(What is it I want to do?) fewer arguments.

2. Obstacles (What difficulties seem to be in my way?)	3. Assets (What advantages have I to work with?)	4. Possible Solutions (What can I do to get what I want?)	5. Probable Results (If I do it, what may be the results?)
a) My brother and I often want the car at the same time.	a) My gang would be willing to help me find the right answer because they have the same troubles.	a) Get a car of my own.	a) I'd have to earn t money; besides, th maintenance costs insurance are terr fic. I'd have to spend everything c the car.
b) Dad & Mother don't seem to have confidence in my driving ability.	b) My parents trust me in most other situations.	b) Check with my brother in advance when I want the car.	b) My brother & I wor always be asking f the car at the sa time.
c) Dad says I'm hard on the car.	c) My brother is willing to work out a solution with me.	c) Ask the auto-shop teacher & school librarian for material on driving, & ask Dad to drive with me for a while.	c) When Dad sees that can handle the ca he won't be so wo ried about letting me have it alone.
d) Mother says we can't afford to drive the car so much.		d) Make an arrangement with my brother to check the car regularly at the service station.	d) If my brother & I regularly check t battery, oil, and water, & keep it clean, it will cu down repair bills
		e) Announce my plans in plenty of time so they won't interfere with anyone else's.	e) If my parents kno in advance where going they may be able to make othe plans.

6. The best solutions for me: a) To buy my own car would cost too much; it wouldn't be worth i
b) A combination of the other situations will help me to solve the problem without too much time & effort.

Problem Solving References

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7. Seashore, Robert H. and Van Dusen, A.C. *How to solve Your Problems*. Chicago: S.R.A., 1954.

8. Warters, Jane. *Achieving Maturity*. N.Y.: McGraw-Hill Book Co., 1949.

VISUAL AIDS:

1. Finding Your Life Work (Voc. Guidance Film)

2. How to Apply for, Win and Advance on the Job (Society for Visual Education, Inc.)

3. Human Relations Series (Commission on Human Relations of the Progressive Education Association)

TECHNICAL MATHEMATICS II

INDUSTRIAL PREP MATHEMATICS II

Industrial Prep Mathematics II has been developed to extend the student's knowledge of those topics in mathematics which are fundamental for further technical study. The Industrial Prep Mathematics II course has dropped the lead role used by the first-year course. During the junior year Industrial Prep Mathematics II plays a supporting role for Industrial Prep Physics. It also plays a minor role in supporting the Industrial Prep English Teacher during that course's study of borrowing money for the purchase of a car.

The major topics studied in Industrial Prep Mathematics II are: Introduction to Algebra, Introduction to Vectors, Introduction to Simple Machines, and Introduction to Electricity. In each topic, the teacher stresses those fundamentals of mathematics which will be used by the Industrial Prep Physics teacher. The mathematics instructor also stresees those types of calculation and manipulative skills which help improve the students' capability in their study of physics.

The approach is much the same as that used in the sophomore year. A daily presentation is accompanied by classwork and homework assignments and tests.

Introduction to Algebra

Lesson 1

I. Introduction to the slide rule.

- A. Each student receives a twelve-inch slide rule.
  - 1. Teacher, using demonstration slide rule:
    - a. Identifies parts: body, slide, hairline-indicator.
    - b. Explains care of slide rule.
    - c. Purpose of slide rule.

- B. Teacher demonstrates scale markings on C and D scales.
  - 1. Use demonstration rule with all scales covered except for C and D scales.
  - 2. Note that scale markings on C and D scales are the same.
  - 3. Explain that scale markings represent numbers from 1 to 10.

- C. Demonstrate process of multiplication of integers.
  - 1. Have C and D scale markings covered by masking tape except for unit and half-unit markings.
    - a. Left end of C scale over first factor (on scale.)
    - b. Read scale for second factor on C scale.
    - c. Read corresponding mark on D scale as the product.
  - 2. Stress that each setting on slide rule indicates many multiplication problems of numbers having the same digits as the given problem, but different in size.

- D. Demonstrate division using the C and D scale
  - 1. Using a divisor of 2, show that one setting of slide indicates many division problems as well as the related multiplication problems.

- E. Classwork:
  - 1. Students practice estimation of products and quotients.
  - 2. Students practice reading C and D scales for all units and half-units.
  - 3. Students try multiplication problems on slide rule and compare settings with those on demonstration rule.

II. Assignment: Multiplication and division of multiples of (.5) including numbers other than those between 1 and 10.

1

Name________________________ Date____________

Lesson 1
Classwork and Assignment

1. Write your estimate of the size of each product.

2. Practice using the slide rule to calulate each product.

3. Write the product.

	Estimate	Product
1. 2.5 x 2.5		
2. 1.5 x 3.0		
3. 4.0 x 1.5		
4. 4.5 x 1.5		
5. 6.0 x 1.5		
6. 5.5 x 1.5		
7. 3.0 x 2.5		
8. 2.5 x 3.5		
9. 5.0 x 1.5		
10. 6.0 x .5		

1. Write your estimate of the size of each quotient.
2. Practice using the slide rule to calulate each quotient.
3. Write the quotient.

	ESTIMATE	QUOTIENT
1. 9.0 ÷ 3.0		
2. 7.5 ÷ 2.5		
3. 5.0 ÷ 2.5		
4. 6.0 ÷ 1.5		
5. 7.0 ÷ 3.5		
6. 8.0 ÷ .2		
7. 9.0 ÷ 1.5		
8. 3.0 ÷ .5		
9. 4.5 ÷ .5		
10. 5.0 ÷ 4.0		

Introduction to Algebra

Lesson 2

I. Review homework on reading scales, multiplication, division.
  A. Stress need to estimate a result before using slide rule

II. Introduce the method of reading scale markings on C and D scale.
  A. Markings are not equally spaced (as on ruler).

  B. Spacings between consecutive unit marks are considered to have 100 equal parts.
    1. Each space is $\frac{1}{100}$, or .01 of a unit distance.

  C. Show graduation of scale markings between 1 and 2.
    1. There are 100 spaces; each is .01 of a unit.

  D. Show graduations of scale markings between 2 and 3.
    1. There are 50 spaces; each space is $\frac{2}{100}$ or .02
      a. Thus, 100 spaces are accounted for.

  E. Show graduation of scale markings between 4 and 5.
    1. There are 20 spaces; each space is $\frac{5}{100}$ or .05.
      a. Thus, 100 spaces are accounted for.

III. Classwork: Practice reading scale markings
  A. Practice on the three types of scale graduations.
    1. Scale from 1 to 2
    2. Scale from 2 to 4
    3. Scale from 4 to 10

VI. Assignment: Mimeographed page. Write the number represented by each indicated mark on the drawing of a slide rule.

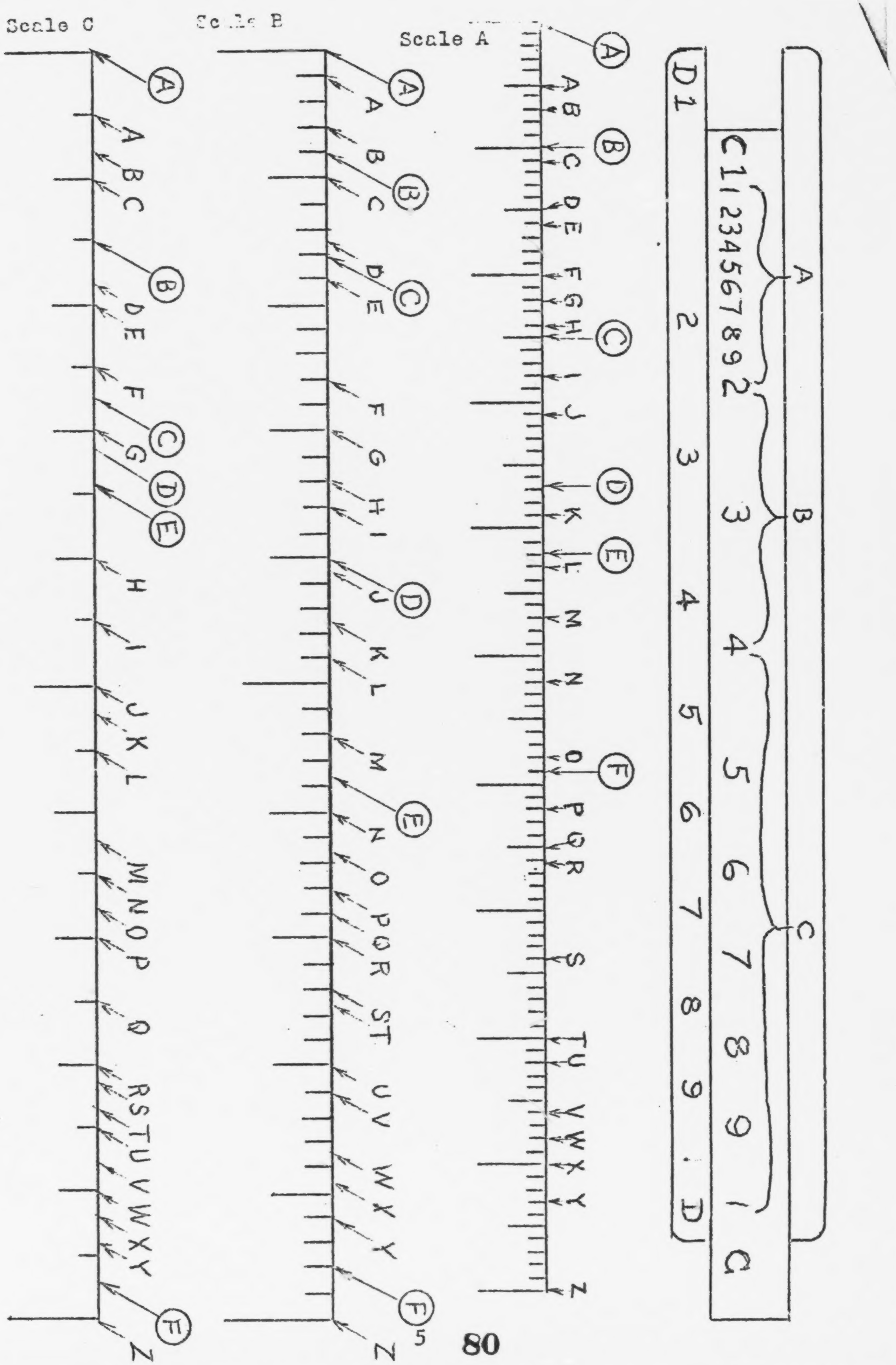
Lesson 3

I. Review homework: reading graduation on C and D scales

II. Introduce multiplication using the full C and D scale.
  A. Stress basic techniques
    1. Estimating product.
    2. Reading scales in hundredths of a unit.
    3. The slide rule indicates three digits of the product. The operator must find its size.

  B. Introduce multiplication yielding a product greater than 10.
    1. Demonstrate the use of the right-hand end of the C scale.
    2. Show how to estimate the product.

  C. Introduce division in which the dividend is greater than ten.
    1. Show how to estimate the quotient.


Scale C
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C 1 1 2 3 4 5 6 7 8 9 2 3 4 5 6 7 8 9 1 C
D 1 2 3 4 5 6 7 8 9 . D
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

Introduction to Algebra

Name______________________________ Date________________

Lesson 2
Classwork and Assignment

For each scale shown on the next page write the numerical reading of the point indicated by the arrow named by the corresponding letter of the alphabet:

		SCALE				SCALE	
Point	A	B	C	Point	A	B	C
A				N			
B				O			
C				P			
D				Q			
E				R			
F				S			
G				T			
H				U			
I				V			
J				W			
K				X			
L				Y			
M				Z			

Lesson 3 (continued)

- D. Introduce division in which the numbers are less than one.

III. Classwork and Assignment

- A. Practice using the slide rule
    - 1. Reading scales, estimating, multiplying, dividing.

I

Name________________________ Date______________

Lesson 3 Classwork

1. Estimate each result.
2. Use your slide rule to find the digits of the resulting number.

	Estimate	Product
1. 1.8 x 3.5		
2. 1.4 x 2.5		
3. 3.2 x 4.5		
4. 5.4 x 2.5		
5. 8.5 x 3.6		
6. 2.14 x 5.0		
7. 4.25 x 6.0		
8. 6.60 x 3.5		
9. 6.60 x 4.5		
10. 8.90 x 3.10		

	Estimate	Quotient
1. 24.0 ÷ 3.0		
2. 46.0 ÷ 4.0		
3. 460. ÷ 4.0		
4. 42.0 ÷ 8.0		
5. 380. ÷ 18.0		
6. 270. ÷ 15.0		
7. 2.70 ÷ 1.5		
8. 8.60 ÷ 4.6		
9. 4.40 ÷ 5.80		
10. .52 ÷ 13		

Name________________________ I   Date____________

Lesson 3   Assignment

For each exercise:
1. Write your estimate of the resulting number.
2. Use the slide rule to find the digits of the resulting number.
3. Write the resulting number, accounting for its size.

	Estimate	Product
1. 9.5 x 6.0		
2. .25 x 8.0		
3. 2.6 x 9.0		
4. .50 x 17.0		
5. 1.50 x 8.0		
6. .75 x 12.0		
7. 12.5 x 4.0		
8. .125 x 12.0		
9. .56 x .25		
10. .46 x .72		

	Estimate	Quotient
1. .46 ÷ .02		
2. 4.60 ÷ 2		
3. 785 ÷ 35		
4. 8.35 ÷ 4.5		
5. 8.95 ÷ 9.5		
6. 8.55 ÷ 6.5		
7. 1.25 ÷ .5		
8. 3.50 ÷ .75		
9. .95 ÷ .05		
10. .50 ÷ 1.50		

AN INTRODUCTION TO ALGEBRA

Lesson 4

I. Numerical phrases.

- A. Numerals: names for numbers.
  - 1. Introduce the concept of a numerical expression and the common name for a number.
    - a. Note that each person knows the common names.
    - b. "5" is the common name for (3 + 2), (4 + 1), (8 - 3).
  - 2. Numerical phrases
    - a. An expression using more than one numeral and one or more operation symbol.
  - 3. Classwork: next to each common name list several other names for the same number. Ditto sheet. Complete for homework.

Lesson 5

I. Order of operations.

- A. Numerical phrases; review.
  - 1. "5 + 3" is a numerical phrase; 8 is its common name.
- B. Order of operations for phrases involving addition and miltiplication.
  - 1. Teacher presents a set of numerical phrases and asks students to find the common name for each.
  - 2. Note that students will find two different common names, depending upon the order of operations used.
  - 3. Teacher emphasises that in order to be consistent, we must require that each numerical phrase have one and only one common name.
  - 4. In order to find the universally accepted rule to find the common name of an expression, the students are asked to consider the following examples:

1. 6 + 3 x 4 = 18
2. 5 + 3 x 4 = 17
3. 5 x 3 + 2 = 17
4. 7 + 2 x 3 = 13
5. 3 + 4 x 2 = 11
6. 7 x 3 + 4 x 2 = 29
7. 7 + 3 x 4 + 2 = 21
8. 7 + 3 + 4 x 2 = 18

Name ______________________ Date ________

Lesson 4.
Classwork and Assignment.

Give the common name for each of the following numerical phrases:

1. $10 + 2$

2. $5 - 2$

3. $\frac{4 \times 3}{2}$

4. $\frac{3 - 1 + 5}{7}$

5. $\frac{30}{10}$

6. $\frac{10}{30}$

7. $\frac{8}{10}$

8. $\frac{8 + 1}{10}$

9. $\frac{5}{10}$

10. $3\frac{1}{2} + 2\frac{1}{2}$

11. $1\frac{1}{4} + 1\frac{1}{4}$

12. $\frac{1}{3} + \frac{3}{1}$

13. $8 - 3$

14. $\frac{42}{3}$

15. $9 + 4$

16. 9×4

17. $\frac{3}{4} + \frac{1}{4}$

18. 5×0

19. $\frac{5 - 2 + 1}{4}$

20. $\frac{2 + 3 - 1}{4}$

21. $\frac{1}{3} + 5 - \frac{1}{3}$

. $\frac{2 \times 6}{3}$

23. $\frac{7 - 2}{5} \times 0$

24. $5 + 10$

25. $\frac{7}{2} \times \frac{2}{2}$

26. $\frac{6}{7} + \frac{3}{2}$

27. $\frac{4 \times 6}{12}$

28. $\frac{3 + 1}{2}$

29. $13 \times 25 \times 4 \times 100 \times 0$

30. $25 \times 17 \times 32 \times 0 \times 173$

Lesson 5 (continued)

C. Rule for determining the common name for numerical phrases.
   1. First: reading from left to right, do all multiplication.
   2. Next: reading from left to right, do all addition.

D. Students are asked to determine, from examples, the rule which is universally accepted to find the common name of a phrase when addition and division are involved:
   1. $8 + 4 \div 2 = 10$ 3. $3 + 9 \div 3 = 6$
   2. $8 \div 2 + 2 = 6$ 4. $16 \div 2 + 4 \div 2 = 10$

E. Rule:
   1. First: reading from left to right, do all divisions.
   2. Next: reading from left to right, do all additions.

II. Classwork and homework: Ditto sheet.

Lesson 6

I. Order of Operations.

A. Quiz and review. Classwork: ditto sheet.

II, Order of operations involving miltiplication and division.

A. Find the common name for each of the following numerical phrases:
   1. $8 \times 4 \div 2$ 2. $8 \div 2 \times 4$ 3. $8 \times 10 \div 2 \times 5$

B. Rule:
   1. Reading from left to right, do all multiplications and/or divisions as they occur.

III. Order of operations involving multiplication, division, and addition.

A. Teacher asks students to find a common name for each of the following numerical phrases:
   1. $12 \div 2 + 4 \times 2$ 2. $24 + 12 \div 2 \times 3$

B. Rule:
   1. First: reading from left to right, do all multiplication and/or divisions as they occur.
   2. Next: reading from left to right, do all addition.

C. Examples:
   1. $12 \div 2 + 4 \times 2 = 14$ 2. $24 + 12 \div 2 \times 3 = 42$

IV. Classwork and assignment on ditto sheet.

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Lesson 5
Classwork and Assignment

Find the common name for each of the following:

1. 8 + 3 x 2
2. 6 + 5 x 7
3. 9 + 7 x 3
4. 4 x 6 + 8 x 3
5. 4 x 3 + 9

6. 7 + 8 x 16
7. 7 x 6 + 4 x 19
8. 8 x 12 + 7
9. 8 + 9 x 12
10. 9 + 7 x 18

11. 30 ÷ 6 + 24 ÷ 6
12. 45 ÷ 9 + 56 ÷ 7
13. 19 + 63 ÷ 7
14. 72 + 84 ÷ 6
15. 35 + 72 ÷ 4

16. 17 + 56 ÷ 3
17. 26 + 76 ÷ 4
18. 18 + 108 ÷ 4
19. 52 ÷ 13 + 17
20. 85 ÷ 5 + 19

21. 7 + 9 x 3 + 12 ÷ 3
22. 6 x 8 + 7 + 4 + 8 ÷ 2
23. 36 ÷ 3 + 9 x 2
24. 15 + 24 ÷ 8 + 7 x 2
25. 140 ÷ 7 + 35 ÷ 5

26. 6 x 5 + 3 x 8 + 7 x 6 + 3 x 5
27. 7 x 3 + 8 x 2 + 4 x 6 + 3 x 9
28. 350 ÷ 7 + 27 x 3 + 56 ÷ 8
29. 82 ÷ 2 + 94 ÷ 2 + 17
30. 17 + 18 x 2 + 32 ÷ 2

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Lesson 6 Quiz

Evaluate each expression following the order of operations.

1. 7 + 8 x 6

2. 9 + 64 ÷ 4

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Lesson 6 Classwork

Find the common name for each of the following numerical expressions.

1. $7.30 + 3 x $.84
2. $ .56 + $4.50 ÷ 9
3. 3 x $.65 + 5 x $.17
4. $3.50 ÷ 7 + $2.40 ÷ 6
5. $7.50 x 2 + $3.80 x 3

6. $8.50 ÷ 5 + $3.20 ÷ 4
7. 7.2 x 5 + 4.6 ÷ 2
8. 8.4 ÷ 2 + 7 x 3.2
9. 4.5 x 3 + 7.2 x 5
10. 12.5 ÷ 5 + 78 ÷ 2

11. 21 ÷ 3 + 35 ÷ 7 + 9
12. 7 + 2 x 7 - 2 - 4 x 3
13. 24 ÷ 2 + 15 ÷ 3 + 8 ÷4
14. $9.52 x 2 + $7.50 x 3
15. $1.40 ÷ 7 + $2.70 ÷ 9

16. $.85 x 3 + $.27 x 2 + $.81 x 3
17. $3.50 ÷ 7 + $.84 ÷ 3 + $.93
18. $1.70 x 2 + $4.80 x 6 + $.30 x 9
19. $7.80 ÷ 2 + $.35 ÷ 5 + $3.50 ÷ 7
20. $12.80 ÷ 8 + $.75 ÷ 5 + $4.50 ÷3

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Lesson 6 Assignment

Find the common name for each of the following numerical expressions.

1. 3 x 6 ÷ 2 x 4
2. 2 x 5 ÷ 2 x 7
3. 8 x 3 ÷ 4 x 6
4. 4 x 7 ÷ 14 x 7
5. 12 x 5 ÷ 6 x 4

6. 4 x 3 x 5 ÷ 12 x 3
7. 14 ÷ 2 x 9 ÷ 21 x 2
8. 8 x 6 ÷ 24 ÷ 2
9. 7 x 8 ÷ 14 ÷ 2
10. 8 ÷ 2 x 7 ÷ 2

11. 8 x 6 ÷ 12 x 5 + 7
12. 3 + 5 x 8 ÷ 10 x 3 + 9
13. 18 ÷ 6 x 2 ÷ 3 x 4
14. 5 + 8 ÷ 2 x 3 + 12
15. 7 + 24 ÷ 6 x 2 ÷ 4

16. 18 ÷ 6 x 4 ÷ 6
17. 18 x 6 ÷ 4 x 6
18. 14 x 2 ÷ 7 x 2 ÷ 4
19. 14 + 2 x 7 x 3 ÷ 14
20. 9 x 8 ÷ 24 x 5 + 12

21. $3.50 x 3 + $7.50 ÷ 5
22. $8.40 ÷ 4 + $3.20 x 7
23. $2.40 x 6 + $3.50 ÷ 5
24. $3.84 ÷ 6 + $2.72 x 3
25. 9 x 7 ÷ 3 x 4 ÷ 2 x 6 +3

26. 12 ÷ 3 x 7 ÷ 2 x 5 ÷ 10
27. $6.50 ÷ 13 + $2.25 ÷ 15
28. $4.50 ÷ 15 + $7.50 ÷ 15
29. $8.60 ÷ 4 + $2.30 x 3
30. $.75 x 7 + $9.00 ÷ 15

Lesson 7

I. Quiz and review on order of operations.

II. Develop rules for finding common name of numerical phrases which involve subtraction.

A. Teacher asks students to find a common name for each of the following numerical phrases:
1. 9 + 3 - 5 - 2   2. 16 - 5 + 6 - 4

B. Teacher develops rule: following all other operations, do the indicated operations of addition and/or subtraction as they occur from left to right. Thus:
1. 9 + 3 - 5 - 2 = 5   2. 16 - 5 + 6 - 4 = 13

III. Evaluating expressions involving the four operations.

A. Find the common name for each of the numerical expressions assigned following the rule:
1. Do all multiplications and/or divisions, reading from left to right,
2. Then do all additions and/or subtractions, reading from left to right.

IV. Classwork and assignment on ditto sheet.

Lesson 8

I. Quiz and review.

II. Develop rules for finding the common name of numerical phrases involving parentheses.

A. First do all work inside parentheses to find the common name of the expression(s) in parentheses; follow the steps (B) and (C) to do so.

B. Next continue finding the common name for the resulting expression by doing all multiplication and/or divisions reading from left to right.

C. Last, do all additions and/or subtractions reading from left to right.

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Lesson 7

Classwork and assignment

Find the common name for each numerical expression.

1. $5 \times 3 - 4$
2. $7 \times 2 - 3$
3. $7 - 2 \times 3$
4. $7 + 2 \times 3$
5. $7 \times 2 + 3$
6. $\frac{1}{2} \times 4 + \frac{1}{2}$
7. $\frac{1}{2} + 4 - \frac{1}{2}$
8. $\frac{1}{2} \times 4 - \frac{1}{2}$
9. $4 \times \frac{1}{2} - \frac{1}{2}$
10. $5 \times 2 \div 10$
11. $5 + 5 \div 10$
12. $6 - 2 \div 1$
13. $13 + 2 \div 2$
14. $21 + 1 \times \frac{1}{2}$
15. $10 \div 2 + 3$
16. $\frac{3}{4} \times \frac{1}{2} + \frac{1}{2}$
17. $120 - 118 + 2$
18. $2 \times \frac{9}{2} \div 3$
19. $13 - 3 \times 2$
20. $13 - 2 \times 3$
21. $\frac{3}{7} + \frac{1}{7} \times 4$
22. $40 + 4 - 1$
23. $40 - 4 \times 9$
24. $2 + 4 \times 5$
25. $2 \times 5 + 5$
26. $14 + 3 \times 2$
27. $15 - 4 \times \frac{2}{4}$
28. $\frac{1}{2} \times 2 + 6$
29. $3 + 5 \div 1$
30. $5 \times 7 - 2$
31. $7 + 3 - 2 + 5 - 4$
32. $13 \times 2 - 4 \times 5$
33. $9 \times 8 - 4 + 7$
34. $7 - 4 + 8 \times 9$
35. $34 - 14 + 7 \times 6$
36. $7 \times 2 - 4 \times 3 + 7 - 2 + 5$
37. $4 - 32 \div 8 + 7 - 4$
38. $24 \div 2 + 15 \div 3 + 4 \times 8$
39. $21 \div 3 - 6 \times 1 + 4 \times 3$

III. Introduce "numerical sentences".

A. "Three plus five is a name for eight" is a sentence. If we translated this sentence into symbolic form we would write: "3 + 5 = 8".
   1. This complete thought is called a sentence.
   2. The symbol "=" is used as a shorthand notation
for: for:
      a. "is equal to",
      b. "is a name for", or
      c. "represents the same number as".

B. "5 + 3 = 7" is also a sentence. It is a false sentence.

C. Classwork and assignment on ditto sheet.

Lesson 9

I. Review order of operations.

A. Quiz; classwork: find the common name
   1. 12 x 3 - 4 x 8   2. $\frac{6 \times 5 \times 2}{2 \times 6 \times 5}$

B. Analyze use of vinculuum (———) in (2.) above.
   1. Note that:
      a. 5 x 2 = 2 x 5
      b. 6 x 5 = 5 x 6
      c. 6 x 5 x 2 = 2 x 6 x 5

II. Using parentheses to change the order of operations.

A. Parentheses () are used to indicate that part of an expression is to be evaluated first.
   1. Using parentheses, we can make the expression "6 + 3 x 4" represent 36.
      a. We cannot break the rule already accepted; that rule makes the expression represent 18.
      b. Using parentheses about the "6 + 3", (6 + 3)x4 will represent 36 because we are now told to add "6 + 3" first.

III. Classwork and homework: place parentheses in each expression so that the given numerical phrase will represent the given common name.

Lesson 10

I. Quiz and review. Use of parentheses in mathematics.

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Lesson 8
Classwork and Assignment

Find the common name for each numerical phrase:

1. 2 x 5 + 7
2. 2 (5 + 7) =
3. (4 + 15) (2 + 5) =
4. 4 + 15 (2) + 5 =
5. $\frac{1}{2}(5 + 7 \times 3) =$
6. $4(5) + \frac{9}{3} =$
7. 4 + (3 x 5) =
8. 4 + 3 x 5 =
9. 14 - 3 x 2 =
10. (14 - 3) 2 =
11. $\frac{(6 + 2)}{[illegible]} + 5 =$
12. 4 (3 + 1) - (4 + 1) =
13. 4 (3 + 1) - 4 + 1 =
14. $\frac{5(6 - 2)}{10 - 3} =$
15. $\frac{(7 - 2)(3 + 1)}{15} =$
16. $\frac{6}{(8 - 5)} =$
17. (6 - 1) 5 =
18. 3 x (4 + 2) =
19. (3 + 2) (4 - 1) =
20. 2 (4 + 6) =
21. (15 - 2) + (3 - 1) =
22. 15 - (2 + 3 - 1) =
23. 6 - 1 x 5 =
24. 4 (2 + 7) =
25. $10\,\frac{(20 + 1)}{5 - 2} =$
26. 3 x 8 - 4 (7 - 2) + 4 x 5
27. $\frac{17 - 5}{3} - 2 + \frac{8 + 14}{11} =$

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Lesson 9
Classwork

Place parentheses in the left-hand expression of each sentence so that the given numerical phrase will equal the common name given.

1. $6 + 3 \times 4 = 36$
2. $2 \times 5 + 7 = 24$
3. $14 - 3 \times 2 = 22$
4. $\frac{1}{2} \times 5 + 3 = 6$
5. $\frac{1}{2} \times 6 + 3 = 4\frac{1}{2}$
6. $2 \times 3 + 4 = 14$
7. $2 \times 3 + 4 \times 3 = 18$
8. $2 \times 3 + 4 \times 3 = 42$
9. $7 - 2 \times 3 + 1 = 20$
10. $6 \div 8 - 5 = 2$

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Lesson 9 Quiz

Find common name for the following:

1. $35 - 6 \times 2 + 1$

2. $12 \times 4 - 2 \times 6$

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Lesson 9
Assignment

A. Find the common name of each numerical expression.

1. 15 ÷ 2 + 4
2. 13 ÷ 234
3. 9 - 14 ÷ 8
4. 10 - 3 + 4
5. 7 + 3 - 4
6. 7 x 2 - 5
7. 34 - 5 x 6
8. 7 x 6 - 3 + 5
9. 13 x 2 - 4 x 6
10. 12 x 3 - 4 x 8
11. 8 - 4 + 7 x 6
12. 34 - 15 + 7 x 5
13. 3 x 5 - 4 x 3 - 5 + 2
14. 8 x 9 - 3 x 7 - 5 + 1
15. 3 x 4 - 5 x 2 - 2 + 7 x 8
16. 7 x 8 - 2 + 3 x 4 - 2
17. 35 ÷ 7 + 5 - 2 x 3 + 8 ÷ 4
18. $\frac{6 \times 5 \times 2}{2 \times 6 \times 5}$
19. 185 x 324 x 1298 x 0
20. 176 - 124 + 37 x 2
21. $\frac{18 \times 24 \times 32 \times 547}{32 \times 547 \times 18 \times 24}$
22. 25 - 19 + 4 x 30
23. 15 x 3 - 17 x 2 + 7
24. $\frac{374 \times 256 \times 5483}{5483 \times 374 \times 256}$

B. Put parenthesis in the following expressions making the numerical phrases equivalent to the common name.

25. 6 + 5 x 2 = 22
26. 14 - 3 x 2 = 8
27. 4 + 2 x 3 - 1 = 12
28. 6 - 3 + 1 = 2
29. 4 x 3 + 1 - 4 = 12
30. 4 + 15 x 2 + 5 = 133
31. 4 + 15 x 2 + 5 = 39
32. $\frac{1}{2}$ x 5 + 7 = 6
33. 0 x 4 + 3 = 0
34. 6 + 1 x 3 - 2 = 7
35. 15 - 3 x 2 = 24
36. 2 x 5 + 3 x 2 = 32
37. 3 x 8 - 4 = 12
38. 3 x 8 - 4 = 20

A. Symbols of inclusion.
1. Find common name for each of the following phrases:
a. $(8 + 3) \times 5$
b. $(7 - 2) \times 4 - (9 - 5) \div 2$
c. $4 \times (9 + 3) \div 6 - (7 - 5) \times 3$

B. General rule for evaluating numerical phrases.
1. First: reading from left to right, do all work in parentheses following steps (2) and (3) (below) to evaluate each expression included in parentheses,
2. Next: reading from left to right, do all multiplication and/or division.
3. Finally: reading from left to right, do all additions and/or subtractions.

C. Parentheses may be used as symbols for multiplications
1. The operation "2 times 3" may be written in the following forms:
a. 2×3
b. $2 \cdot 3$
c. $(2)(3)$
d. $2(3)$
e. $(2)3$

II. Introduction to distributive property of multiplication over addition

A. $(5 + 4)2$ can be interpreted to mean:
1. "Add five twos to 4 more twos"; that is,
a. $(5 + 4)2 = (5)2 + (4)2.$
$= (2 + 2 + 2 + 2 + 2) + (2 + 2 + 2 + 2)$
b. This is equivalent to $(9)2$, which is the result of following the previously accepted rule.

B. Thus, we have an alternate rule for evaluating an expression which involves a sum followed by a product.
1. (first + second) (third) = (first) (third) + (second) (third)

C. Try both rules on this expression. Which is easier to calculate?

1. $8(\frac{1}{2} + \frac{1}{4})$
a. First rule: $8(\frac{3}{4}) = 2(3) = 6$
b. Second rule: $8(\frac{1}{2}) + (\frac{1}{4}) = 4 + 2 = 6$

III. Classwork and assignment: ditto sheet.

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Lesson 10
Classwork

Do the following examples.
Find the common name for each numerical phrase.
(a) By adding (or subtracting) first and then multiplying.
(b) By multiplying each term and then adding (or subtracting).

1. 3 (4 + 2) =

2. 6 (3 + 6) =

3. 5 (7 + 1) =

4. 3 (1 + 2) =

5. 8 (11 + 6) =

6. 7 (9 + 2) =

7. 4 (13 + 6) =

8. 25 (4 +7) =

9. 3 (8 + 2) =

10. 6 (3 + 1) =

11. 4 (2 + 6) =

12. 5 (3 + 2) =

13. 11(5 x 6) =

14. 7 (8 + 5) =

15. 4 (8 - 2) =

16. 5 (11- 3) =

17. 9 (4 - 1) =

18. 3 (10 - 2)=

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Lesson 10 Assignment

Find the common name for each numerical phrase using two methods.

1. 6 x 2 + 6 x 3 =
2. 5 (3) + 5 (8) =
3. 3 (6) + 3 (2) =
4. 4 (10) + 4 (2) =
5. 8 (2) + 8 (3) =
6. 5 x 6 + 5 x 1 =
7. 3 x 2 + 3 x 4 =
8. (6) 2 + (7) 2 =
9. 4 (3) + 4 (1) =
10. 5 x 2 + 5 x 3 =
11. 5 x 8 - 5 x 2 =
12. 6 x 6 - 6 x 3 =
13. 3 x 2 + 3 x 1 =
14. 7 x 3 + 7 x 2 =
15. 6 (8) - 6 (1) =
16. 4 (2) + 4 (1) =
17. 8 (8) + 3 (2) =
18. 2 (2) - 2 (1) =
19. 3 (2) + 3 (1) =
20. 7 (3) + 7 (5) =

Tell which of these sentences are true and which are examples of the rule used in the (above) exercises:

1. 3 (5 + 2) = 3(5) + 3(2)
2. 7 (6 + 1) = 7(6) + 7(1)
3. 2 x 5 + 4 x 5 = (2 + 4)5
4. (7 + 8)2 = 7 x 2 + 8 x 2

Can you make a rule from the above work?

Rule 4 (3 + 2) =

5 (2) + 5 (3) =

Lesson 11

I. Develop experience with the distributive property.

A. Review the property showing the advantage in knowing both possible rules of order of operation.

1. $14(\frac{5}{7} + \frac{1}{2}) = 14(\frac{5}{7}) + 14(\frac{1}{2}) = 2(5) + 7(1) = 10 + 7 = 17$

2. $2 \times 13 + 2 \times 17 = 2(13 + 17) = 2 \times 40 = 80$

B. Classwork and assignment: ditto sheet.
   1. Half-period test tomorrow.

Lesson 12

I. Algebraic expressions.

A. Variables. Develop the correspondence between the concepts of noun-pronoun and numeral-pronumeral.
   1. Mr. Johnson is President of the U.S.A. (noun)
   2. He is President of the U.S.A. (pronoun)
   3. 7 + 8 represents the number 15
   4. 7 + ___ represents a number if we fill in the blank with a numeral.
      a. The blank space is called a "pronumeral".
         i. It holds the place of a numeral.
   5. Symbols for pronumerals.
      a. , , , a, x, y, etc.

B. Replacements for a variable.
   1. The expression + 5 is called an open phrase.
      a. Note that different numbers are represented by the phrase, depending upon the replacements for .
   2. Represent the following word phrases as open phrases using the given symbol for the pronumeral.
      a. "a number increased by 5", □ ;
      b. "8 less than a number"; △,
      c. "6 times a number"; x ,
      d. "a number divided by 12; a .
   3. Introduce the symbols for "is more than" and "is less than".

II. Classwork and assignment: Study notes and complete ditto sheet.

Lesson 13

I. Algebraic expressions.

A. Quiz (translate two word phrases to algebraic phrases) and review concepts of variable and open phrases.

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Lesson 11
Classwork

Perform the indicated operations in the easiest way. Show your method.

1. $110 (8) + 110 (92)$
2. $12 (\frac{1}{3} + \frac{1}{4})$
3. $27 (\frac{7}{8}) + 27 (\frac{1}{8})$
4. $\frac{1}{5} (\frac{7}{8}) + \frac{1}{5} (\frac{1}{8})$
5. $3 (\frac{2}{12}) + \frac{5}{12}$
6. $6 (\frac{2}{3} + \frac{3}{2})$
7. $9 (11 + 9)$
8. $98 (100 + 2 (100)$
9. $5 (\frac{1}{5} + \frac{4}{3})$
10. $7 (8 + \frac{3}{7} + \frac{1}{7})$
11. $7 (\frac{1}{3}) + 7 (\frac{2}{3}) + 7 (5)$
12. $16 + (8 \times 5)$
13. $0 (17 + 83)$
14. $88 (200 + 1)$

Assignment

1. $3 (4 + 2) = 3 (4) + 3(2)$
2. $6 \times (4 \times 2) = (6 \times 4) \times 2$
3. $8 - 2 = 2 - 8$
4. $3 + 4 \times 6 = (3 + 4) 6$
5. $(3 + 2) 7 = 7 (3 + 2)$
6. $3 \times 4 + 2 \times 3 = 3(2 + 4)$
7. $83 + 24 = 38 + 42$
8. $4 + (3 + 1) = (4 + 3) + 1$
9. $(\frac{3}{4} \times \frac{1}{2}) \times \frac{1}{3} = \frac{3}{4}(\frac{1}{2} \times \frac{1}{3})$
10. $6 (3 + 1) = 6 \times 3 + 1$
11. $9 (\frac{2}{5}) = 9 (\frac{3}{5})$
12. $4 + 1 = 1 + 4$
13. $(16 \div 2) \div 3 = 16 \div (2 \div 3)$
14. $13 (10) = 13 (8) + 13 (2)$
15. $(14 + 2 + 1) = (14 \times 2) + (14 \times 1)$
16. $3(2 + 3) = (2 + 3) 3$
17. $5 \times 2 = 2 \times 5$

Lesson 12 — Classwork

Write the following word phrases as open phrases. You may use any symbol to hold the place of the variable.

1. Six more than a number.
2. Four less than a number.
3. Seven times a number.
4. Two times a number plus three.
5. A number divided by 6.
6. Ten added to a number.
7. A number increased by 5.
8. Eight times a number.
9. Seven less than a number.
10. A number divided by 2.

Answers

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

[illegible] ______________ [illegible] ________

Lesson 12   Assignment

Write an open phrase which represents the given word phrase. You may use any symbol to hold the place of the variable.

1. Nine more than a number.
2. Five more than twice a number.
3. Six more than five times a number.
4. Seven less than a number.
5. Seven less than twice a number.
6. Five times a number decreased by seven.
7. Nine greater than five times a number.
8. Twelve more than seven times a number.
9. Twelve less than seven times a number.
10. Nine less five times a number.

Answers

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Lesson 13 (continued)

- B. Replacements for a variable in an open phrase.
    - 1. In real life we use certain types of numbers for special circumstances.
        - a. "Send 7 more children." - integers.
        - b. "Put 3 more cars in the parking lot." - integers.
        - c. "Pencils cost $.05" - decimal fractions
        - d. "Use half a cup of flour." - common fractions
        - e. "There are 560 seats in the room." - integers
        - f. "A new model will cost $2,500.50." - mixed numerals
    - 2. Introduce the concept of the domain of a variable.
        - a. The set of possible replacements for the variable.
        - b. "Evaluate " □ + 5" if the replacement values for □ may be: 1, 3, 5, 7, and 9.
            - i. Note that the values of the resulting expressions are now limited to five values.
        - c. Note that a numerical phrase results once the variable has been replaced.
- C. Classwork and assignment: ditto sheet.

Lesson 14

I. Algebraic expressions; domain of a variable.

- A. Review homework
    - 1. Topics: algebraic expressions, domain, common name, pronumerals, open sentences, true or flase sentences.
- II. Classwork and assignment: ditto sheet.

Lesson 15

I. Quiz and review

- A. Domain of a variable, open sentences.

II. Review of the distributive property and use in algebraic expressions.

- A. Experience in recognizing the forms used.
    - 1. Numerical expression: $3(5 + 4) = 3(5) + 3(4)$
    - 2. Algebraic: $3(x + 2) = 3(x) + 3(2)$

III. Classwork: Find equivalent expressions using the distributive property. Ditto sheet.

- A.. Develop experience in addition of similar algebraic terms.

IV. Assignment: Complete ditto sheet.

Lesson 13 Classwork

Here is a table for you to study.
The square is the variable.
In the first column you are told three values for the variable: 12, 18 and 8. In the first row across you use a 12 in place of . Once we replace the with 12, the phrases are no longer open phrases. Therefore we can find the common name.

Domain	$\square + 5$	$\square - 8$	$6 \times \square$	$\frac{\square}{12}$
12	$12 + 5 = 17$	$12 - 8 = 4$	$6 \times 12 = 72$	$\frac{12}{12} = 1$
18	$18 + 5 = 23$	$18 - 8 = 10$	$6 \times 18 = 108$	$\frac{18}{12} = 1\frac{1}{2}$
8	$8 + 5 = 13$	$8 - 8 = 0$	$6 \times 8 = 48$	$\frac{8}{12} = \frac{2}{3}$

Now you try one. The $\square$ is the variable.

Domain	$\square + 2$	$\square - 6$	$4 \times \square$	$\frac{\square}{5}$
8				
15				
10				
25				

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Lesson 13 Assignment

A. Find the common name for the following open phrases if the variable is 2.

1. $\square + 7 =$

2. $5(\square) =$

3. $\square(11) =$

4. $3(\square - 1) =$

5. $5(\square) - 7 =$

6. $9 - 3(\square) + 6(\square + 1) =$

7. $8(\square) - 3(\square) =$

8. $\frac{(\square - 1)(\square + 2)}{+\ 3} =$

9. $\frac{3(\square)(\square + 2)}{2 \qquad + 4}$

B. Write an expression equivalent to the given expression.

10. $7(\square + 2) + 4(\square) =$

11. $\frac{\square}{8} =$

12. $\frac{\square + 6}{4} =$

13. $\frac{2 \times (\square) - 3}{5} =$

14. $\frac{6(\square + 3)}{5} =$

C. If $\square$ has the value of 2, $\triangledown$ has the value 5, and * has the value 3, find the common names of these open phrases.

15. $\frac{3(*) + 4(\triangledown)}{\square}$

16. $7(\square) - 2\triangledown + \frac{2(*)}{\square} =$

17. $\frac{6(\triangledown) - *}{2} + \frac{3(\triangledown)}{\square} =$

18. $(3(\square) + \triangledown)\ (\triangledown - *) =$

19. $7(*)(\square + \triangledown) =$

20. $(3(\square) - 2(*))\ (2(\triangledown) - 10 =$

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Lesson 14
Classwork

You have learned about open phrases such as n + 3, c - 5, etc. They were phrases which contained variables. In the same way we call sentences which contain one or more variables open sentences.

Thus, the statement $n + 3 = 5$ is an example of an open sentence. Suppose we were asked whether the sentence $n + 3 = 5$ is true. Of course it is impossible to decide until we replace the variable "n" with a numeral.

The sentence - "He is the president of the United States" - presents the same difficulty. Again we cannot decide whether it is true until someone tells us who "he" is.

The open sentence $n + 3 = 5$ becomes true when n is replaced by 2. Therefore, we call the number 2 a truth number for this sentence.

Now let's look at some open sentences. Which of the following open sentences are true if $x = 7$?

1. $x + 2 = 2 + x$
2. $(x + 3) + 4 = x + (3 + 4)$
3. $x - 5 = 2x - 10$
4. $3 (x + 4) = 3x + 12$
5. $x - 10 = 3$
6. $\frac{3}{7}x + 6 = x$
7. $(x - 5) (x - 4) = x - 1$
8. $8x + 9x = 17x$
9. $3x + 2 = 5x$
10. $(x - 4) (x + 7) = \frac{4x}{x}$
11. $11x - 2x = 63$
12. $x (3x + 7) = 3x^2 + 7x$
    Hint: $x^2 = (x)(x)$

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Lesson 14
Assignment

Find a truth number of each of these sentences.

1. $x + 4 = 6$

2. $x + 4 = \frac{11}{2}$

3. $x + 4 = 7$

4. $x + 5 = 7$

5. $x + 6 = 7$

6. $6 - x = 2$

7. $6 - y = 2$

8. $4m = 12$

9. $4m = 14$

10. $3m = 18$

11. $2x + 4 = 6$

12. $2x + 4 = 7$

13. $3x - 2 = 7$

14. $3x - 2 = 0$

15. $5m = 0$

16. $5m = 5$

17. $x + 3\frac{1}{2} = 7$

18. $2x + 5 = 12$

19. $2m - 2 = 8$

20. $2n + 4 = 14$

21. $2x + 8 = 12$

22. $x + 7 = \frac{15}{2}$

23. $5x + 4 = 14$

24. $12 = 2n + 6$

25. $2n + 8 = 18$

26. $14 - 3y = 8$

27. $17 - 3y = 8$

28. $3 + 2y = 10$

29. $19 + 4y = 61$

30. $20 - 3y = 8$

Let's study some open sentences and see if we can find the truth number without being told.

Here's an easy one.

1. $x + 4 = 6$

You say to yourself: What number plus 4 equals 6 or 4 added to what number is 6.

Truth number is _____

2. $a - 5 = 4$

What do you say to yourself?________________________________

The truth number is_____

3. $3x - 2 = 7$

This is a little harder.
Think first: If I don't know x, I don't know 3x either. However, "3x" holds a place for a number.
So: what number minus 2 equals 7? Nine. Therefore, 3x must be replaced by 9.

What must x be replaced by?______

The truth number is______

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Lesson 15
Classwork

Find equivalent expressions using the distributive property.

1. $2 (x + 5) =$
2. $7 (x + 4) =$
3. $8 (a - 2) =$
4. $3 (5 + y) =$
5. $3a + 5a =$
6. $7x + 3x =$
7. $2b + 5b =$
8. $12a + 8a =$
9. $4 (3x + 2) =$
10. $11 (2x + 5) =$
11. $10 (3a + a) =$
12. $3 (5y - 6) =$
13. $7c - 2c =$
14. $14x - 3x =$
15. $9a - 5a =$
16. $7a - 7a =$

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Lesson 15
Assignment

Here are some harder phrases to simplify:

1. $2\ (x + 6) + 5x$
2. $13 + (y - 2)\ 4 =$
3. $3x + 2 + 5x - 1 =$
4. $2\ (x + 4) + x =$
5. $14\ (2x + 1) - 3x =$
6. $3\ (y + 5) + 6 + 2y =$
7. $7\ (4y + 2y + 6) + 10 =$
8. $12 + 4\ (x + 7) =$
9. $7\ (2x + 8) - 11 =$
10. $8 + 4\ (2 + x) =$
11. $5\ (2x + 6) + 3\ (x + 2) =$
12. $7\ (\ x + 5) - 3 =$
13. $6\ (a + 5) + 2a =$
14. $3t + 2\ (t + 5) =$
15. $7x + 5x + 3 + 4 + x =$
16. $3\ (x + 2) + 5\ (x - 1) =$

In each sentence find an expression equivalent to that in the left member. Use the distributive law.

1. $3\ (x + 2) = 21$
2. $7\ (x - 3) = 35$
3. $4\ (x - 3) = 16$
4. $5\ (x - 2) = 30$
5. $8\ (x - 2) = 40$
6. $6\ (x + 4) = 72$
7. $3\ (x - 4) = 33$
8. $2\ (x + 5) = 26$
9. $7\ (x + 2) = 56$
10. $4\ (x - 2) = 20$

Lesson 16

I. Finding simpler algebraic expressions.

A. Quiz and review of homework.
1. Simplify:
a. $3(2x + 3) + 5$
b. $5(3x + 1) + 3(x + 8) + 9x + 2$

II. Simplifying algebraic expressions in open sentences.

III. Classwork and assignment: ditto sheet.

Lesson 17

I. Review: simplifying algebraic sentences.

II. Using equivalent expressions to solve equations.

A. Numerical
1. "5" may be replaced by "3 + 2".
2. "4 + 5" may be replaced by "2 + 7".

B. Algebraic expressions.
1. "3x" may be replaced by "x + x + x".
2. "3x" may be replaced by "2x + x".
3. Using this concept in solving an equation:
a. Find a replacement for x which will make this a true statement:
i. $3x = 12$ Another name for 12 is (3)(4), so

$3x = (3)(4)$ Since these expressions have the same form and the same number of factors,
x must be replaced by 4 to make the above sentence true.
we say: $x = 4$

4. Solve: $x + 3 = 8$ Another name for 8 is "5 + 3".

so: $x + 3 = 5 + 3$,

thus: $x = 5$; that is, x must be replaced by 5 to make the (above) sentence true.

5. Solve: $3x + 1 = 2x + 6$ Another form for 3x is "x + 2x".
$x + 2x + 1 = 2x + 6$
or $2x + x + 1 = 2x + 6$ Since "2x" is an addend in each member, x + 1 must be a name for 6.

$x + 1 = 6$
and $x + 1 = 5 + 1$
thus: $x = 5$

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Lesson 16
Classwork and Assignment.

Now we'll try some open sentences that have these phrases in them. Find the truth number of the following open sentences.

1. $2 (x + 3) = 12$
2. $7x + 5 + 2x - 1 + 40$
3. $15 = 2 (x + 5)$
4. $8 (3x + 2) = 40$
5. $2 (x + 6) + 4 (2x + 2) = 50$
6. $98 = 7 (2x + x + 8)$
7. $4 (x - 3) + x = 3$
8. $\frac{1}{2} (x + 6) = 9$
9. $4 (x - 2) = 16$
10. $8 (x + 2) - 10 = 54$
11. $2 (x + 3) + 5 (x - 1) = 10 - 2$
12. $76 = x + 6 + 5x - 2$
13. $100 - 1 = 11 (x + 6)$
14. $7x + 5 + 2 (x + 6) = 44$
15. $5 x + 6 = y + 22$
16. $2x + 4 = x + 13$

Lesson 17 (continued)

III. Introducing the subtraction axiom.

A. Instead of using equivalent expressions to solve $x + 3 = 8$, we may simply subtract 3 from each member of the equation.

1. Example:

Using equivalent expressions	Using the concept of subtraction from each member
$x + 3 = 8$ $x + 3 = 5 + 3$ $x = 5$	$\begin{array}{rcl} x + 3 &=& 8 \\ -3 && -3 \\ \hline x &=& 5 \end{array}$

B. Classwork: using both methods, find the solution for each equation.

1. $x + 3 = 9$
2. $x + 11 = 13$
3. $x + 3.5 = 7$
4. $x + 5.2 = 9$

IV. Introducing the addition axiom.

A. Using equivalent expressions. Example:

$$\begin{array}{l} x - 3 = 7 \\ x - 3 = 10 - 3 \end{array}$$

Since 7 can be replaced by "10 - 3", and since the members are written in the same form, x must be replaced by 10 to make the (above) equation true. that is: $x = 10$

B. Using the addition axiom. Example:

$$\begin{array}{rcl} x - 3 &=& 7 \\ +3 && +3 \\ \hline x + 3 - 3 &=& 10 \\ x &=& 10 \end{array}$$

We may simply add 3 to each member with the idea in mind that we subtract 3 from it, obtaining a difference of zero.

C. Classwork: Using both methods, find the solution for each equation.

1. $x - 5 = 8$
2. $x - 11 = 12$
3. $x - 2.5 = 6$
4. $x - 7.8 = 3$

V. Assignment: ditto sheet

Lesson 18

I. Solving equation with axioms.

A. Review the reasoning behind the addition and subtraction axioms.

Lesson 18 (continued)

B. Introduce reasoning for the division axiom.

1. Example:

$3x = 24$ — 24 may be replaced by (3)(8)

so: $3x = (3)(8)$ — Since both members have the same form and the same number of factors x must be replaced by 8 to make the (above) equation true;

that is: $x = 8$

2. Using the division axiom:

$3x = 24$

$\frac{3x}{3} = \frac{(3)(8)}{3}$ dividing both members by 3,

$x = 8$

C. Classwork: Using both methods, find the solution for each equation.

1. $5y = 35$
2. $8x = 56$
3. $2.5x = 15$
4. $3x = 7.5$

D. Introduce reasoning for the multiplication axiom.

1. Example:

$\frac{x}{3} = 4$ — 4 may be replaced by $\frac{12}{3}$,

so: $\frac{x}{3} = \frac{12}{3}$, — so x must be replaced by 12 so that the (above) equation will be true.

2. Using the multiplication axiom.

$\frac{x}{3} = 4$

$3(\frac{x}{3}) = (4)(3)$ multiplying both members by 3,

$x = 12$

E. Classwork: Using both methods, find the solution for each equation.

1. $\frac{y}{5} = 2$
2. $\frac{x}{8} = 7$
3. $\frac{x}{3} = 2.5$
4. $\frac{y}{4} = 3.2$

Lesson 19

I. Review: using axiom to solve equations.

A. Quiz
  1. Solve each equation showing your use of an axiom.

B. Review homework.

II. Introduce concepts of ratio and use of fractions.

A. Develop examples.
  1. Phrases showing comparison.
  2. Abbreviations for the phrases.
  3. Fractions or shorthand notation.
  4. Sets of equivalent fractions.
    a. Use property of 1 for multiplication.

B. Classwork on ditto sheet.
  1. Complete table showing the use of fractions.
  2. Develop fractions equivalent to a given fraction.

III. Assignment: Ditto sheet.

Lesson 20

I. Review

A. Homework dealing with equivalent fractions.

B. Classwork ditto sheet.
  1. Solving equations using the axioms.
  2. Finding equivalent fractions.
    a. Use the property of 1 for multiplication.

II. Developing fractions.

A. Use property of 1 for multiplication to find missing terms.

1. $\frac{5}{8} = \frac{X}{24}$ 24 may be replaced by 3x8.

$\frac{5}{8} = \frac{X}{3x8}$

$\frac{5}{8} = \frac{3}{3} x \frac{5}{8}$ multipy $\frac{5}{8}$ by 1 in the form $\frac{3}{3}$.

So: X = 3x5; that is, X must be replaced by 15 to have a fraction equivalent to $\frac{5}{8}$.

D. Introduce the term: "proportions"
  1. A statement that two fractions are equivalent.
  2. Definition of "solving a proportions."

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Lesson 19
Classwork

Complete this table, showing what each shorthand expression represents.

Type of comparison	Abbreviation	Shorthand	
1. Five cents for each pencil	5¢ to each	5:1	$\frac{5}{1}$
2. Ten cents for two pencils	10¢ to 2	10:2	$\frac{10}{2}$
3.			$\frac{15}{3}$
4.		20:	
5.		30:6	
6.		40:	
7.		120:	

List five fractions which are equivalent to each given fraction:

1. $\frac{2}{5}$ = ______ = ______ = ______ = ______ = ______
2. $\frac{3}{7}$ = ______ = ______ = ______ = ______ = ______
3. $\frac{3}{4}$ = ______ = ______ = ______ = ______ = ______
4. $\frac{1}{3}$ = ______ = ______ = ______ = ______ = ______
5. $\frac{5}{7}$ = ______ = ______ = ______ = ______ = ______

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Lesson 19
Assignment

Complete this table, showing what each shorthand expression represents.

Type of comparison	Abbreviation		Shorthand
1. Two feet in height for each three feet in length.	2' to 3'	2:3	$\frac{2}{3}$
2.		6:-	
3.		-:12	
4.		10:-	
5.		18:-	
6.		-:30	

List five factors which are equivalent to each given fraction:

1. $\frac{3}{5}$ = ______ = ______ = ______ = ______ = ______
2. $\frac{4}{7}$ = ______ = ______ = ______ = ______ = ______
3. $\frac{3}{8}$ = ______ = ______ = ______ = ______ = ______
4. $\frac{5}{8}$ = ______ = ______ = ______ = ______ = ______
5. $\frac{4}{5}$ = ______ = ______ = ______ = ______ = ______

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Lesson 20
Practice:

Solve each equation using an appropriate axioms. Show the use of the axioms.

1. $x + 12.5 = 18$
2. $y - 3.2 = 12.8$
3. $4.5x = 18$
4. $\frac{y}{3} = 20$
5. $27x = 9$
6. $35 + x = 43.5$
7. $x - 25 = 7.9$
8. $\frac{x}{5} = 7.2$
9. $36x = 4$
10. $56x = 14$

Complete each list of equivalent fractions:

1. $\frac{2}{5} = \frac{\_\_}{15} = \frac{10}{\_\_} = \frac{4}{\_\_} = \frac{\_\_}{30} = \frac{6}{\_\_} = \frac{14}{\_\_} = \frac{\_\_}{45} = \frac{18}{\_\_} = \frac{28}{\_\_}$
2. $\frac{3}{7} = \frac{12}{\_\_} = \frac{\_\_}{21} = \frac{18}{\_\_} = \frac{\_\_}{35} = \frac{15}{\_\_} = \frac{27}{\_\_} = \frac{\_\_}{56} = \frac{\_\_}{14} = \frac{\_\_}{84}$
3. $\frac{3}{5} = \frac{\_\_}{15} = \frac{18}{\_\_} = \frac{\_\_}{50} = \frac{24}{\_\_} = \frac{\_\_}{10} = \frac{21}{\_\_} = \frac{\_\_}{60} = \frac{33}{\_\_} = \frac{\_\_}{25}$
4. $\frac{3}{10} = \frac{\_\_}{40} = \frac{48}{\_\_} = \frac{18}{\_\_} = \frac{9}{\_\_} = \frac{\_\_}{80} = \frac{45}{\_\_} = \frac{30}{\_\_} = \frac{36}{\_\_} = \frac{\_\_}{150}$
5. $\frac{2}{7} = \frac{\_\_}{42} = \frac{16}{\_\_} = \frac{\_\_}{126} = \frac{28}{\_\_} = \frac{\_\_}{70} = \frac{44}{\_\_} = \frac{\_\_}{84} = \frac{\_\_}{140} = \frac{32}{\_\_}$

Be prepared to tell the form used for 1 to develop each equivalent fraction.

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Lesson 20
Assignment

Complete each list of equivalent fractions. Be prepared to tell the form used for 1 to develop each fraction.

1. $\frac{4}{5} = \frac{\_\_}{15} = \frac{28}{\_\_} = \frac{\_\_}{60} = \frac{32}{\_\_} = \frac{\_\_}{45}$

2. $\frac{5}{8} = \frac{40}{\_\_} = \frac{\_\_}{40} = \frac{\_\_}{88} = \frac{60}{\_\_} = \frac{35}{\_\_}$

3. $\frac{5}{6} = \frac{\_\_}{24} = \frac{\_\_}{36} = \frac{50}{\_\_} = \frac{75}{\_\_} = \frac{\_\_}{66}$

4. $\frac{5}{16} = \frac{\_\_}{48} = \frac{25}{\_\_} = \frac{\_\_}{96} = \frac{\_\_}{64} = \frac{40}{\_\_}$

5. $\frac{7}{8} = \frac{\_\_}{40} = \frac{21}{\_\_} = \frac{28}{\_\_} = \frac{\_\_}{48} = \frac{56}{\_\_}$

*6. $\frac{12}{16} = \frac{6}{\_\_} = \frac{\_\_}{4} = \frac{\_\_}{12} = \frac{24}{\_\_} = \frac{\_\_}{24}$

*7. $\frac{8}{16} = \frac{\_\_}{4} = \frac{4}{\_\_} = \frac{\_\_}{2} = \frac{\_\_}{12} = \frac{3}{\_\_}$

*8. $\frac{24}{32} = \frac{\_\_}{4} = \frac{\_\_}{8} = \frac{\_\_}{16} = \frac{\_\_}{24} = \frac{\_\_}{48}$

*The multipliers may not be whole numbers.

Lesson 20 (continued)

III. Assignment : Ditto Sheet.

Lesson 21

I. Review: Solution of proportions.

  A. Drill on use of forms of 1 for multiplication.
    1. Use pairs of fractions from homework assignment.

  B. Drill on the choice of axiom to solve the same proportions as in (A),

II. Introduce complex fractions.

  A. Definitions
    1. A fraction in which one or both terms are fractions.
    2. Show that 1 can be represented by a complex fraction.

  B. Proportions solved using complex fractions for 1.
    1. Classwork: Ditto sheet.
      a. Using 1 in a form as a complex fraction.

  C. Classwork: Ditto sheet.

III. Introduce "reciprocal" fractions.

  A. Reciprocals of equivalent fractions are also equivalent.
    1. Examples: use in solving proportions.
      a. $\frac{3}{8} = \frac{9}{X}$ leads to $\frac{8}{3} = \frac{X}{9}$.

Lesson 22

I. Review

  A. Quiz
    1. Solve one equation using an axiom.
    2. Develop three fractions equivalent to a given fraction.
  B. Review homework: forms for 1.

II. Introduce Proportions.

  A. Developing identical forms.
    1. Using property of 1 for multiplication.
      a. Use division to find multiplier.

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Lesson 21
Classwork & Assignment

A. Complete each list of equivalent fractions. Be prepared to tell the form used for 1 to develop each equivalent fraction.

1. $\frac{3}{8} = \frac{\quad}{12} = \frac{6}{\quad} = \frac{\quad}{2} = \frac{\quad}{20} = \frac{\quad}{6} = \frac{9}{\quad} = \frac{1}{\quad} = \frac{2}{\quad} = \frac{4}{\quad}$

2. $\frac{2}{5} = \frac{\quad}{15} = \frac{1}{\quad} = \frac{\quad}{10} = \frac{3}{\quad} = \frac{8}{\quad} = \frac{5}{\quad} = \frac{\quad}{20} = \frac{\quad}{1} = \frac{\quad}{3}$

3. $\frac{5}{8} = \frac{10}{\quad} = \frac{\quad}{2} = \frac{15}{\quad} = \frac{\quad}{4} = \frac{\quad}{12} = \frac{\quad}{6} = \frac{1}{\quad} = \frac{2}{\quad} = \frac{3}{\quad}$

4. $\frac{3}{5} = \frac{\quad}{1} = \frac{1}{\quad} = \frac{\quad}{10} = \frac{12}{\quad} = \frac{2}{\quad} = \frac{\quad}{3} = \frac{4}{\quad} = \frac{\quad}{4} = \frac{5}{\quad}$

5. $\frac{7}{8} = \frac{\quad}{1} = \frac{1}{\quad} = \frac{\quad}{2} = \frac{\quad}{3} = \frac{\quad}{5} = \frac{3}{\quad} = \frac{5}{\quad} = \frac{\quad}{7} = \frac{\quad}{6}$

B. For each exercise tell the axiom required to solve the given proportion. Solve each.

1. $\frac{3}{8} = \frac{x}{32}$

2. $\frac{5}{8} = \frac{10}{a}$

3. $\frac{3}{5} = \frac{x}{10}$

4. $\frac{3}{7} = \frac{12}{a}$

5. $\frac{5}{8} = \frac{45}{y}$

6. $\frac{2}{5} = \frac{12}{x}$

7. $\frac{8}{15} = \frac{32}{a}$

8. $\frac{7}{8} = \frac{35}{x}$

Lesson 22 (continued)

B. Developing use of multiplication axiom.
   1. Use reciprocals of fractions if a demominator is to be found.
   2. Multiply only by denominator of fraction which has variable in the numerator.

III. Classwork and assignment: ditto sheet.

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Lesson 22
Classwork and Assignment

4. Solve each proportion using reciprocals fractions, if necessary. Be prepared to tell the axiom.

1. $\frac{5}{8} = \frac{x}{12}$
2. $\frac{7}{8} = \frac{a}{4}$
3. $\frac{3}{16} = \frac{y}{8}$
4. $\frac{15}{30} = \frac{A}{16}$
5. $\frac{15}{30} = \frac{30}{x}$
6. $\frac{5}{8} = \frac{20}{x}$
7. $\frac{10}{8} = \frac{5}{x}$
8. $\frac{15}{21} = \frac{10}{X}$
9. $\frac{27}{36} = \frac{9}{x}$
10. $\frac{75}{80} = \frac{15}{a}$

11. $\frac{7}{8} = \frac{5}{a}$
12. $\frac{14}{15} = \frac{7}{8}$
13. $\frac{7}{8} = \frac{3}{x}$
14. $\frac{15}{16} = \frac{7.5}{a}$

Lesson 23

- I. Review solutions of proporties.
  - A. Quiz
    - 1. List equivalent fractions.
    - 2. Set up and solve a proportion.
  - B. Practice on use of equality of reciprocals in solving a proportion.
  - C. Practice estimating the size of the missing term.
    - 1. Refer to previous assignments.
- II. Introduce solutions of proportions using a slide rule.
  - A. Use C and D scales for the following procedure:
    - 1. Place indicator over mark on D scale for the denominator of the given fraction.
    - 2. Move slide so mark on C scale for numerator of the same fraction is under indicator.
    - 3. Holding slide fixed, move indicator over mark for the given term of the equivalent fraction.
      - a. If numerator is given, locate mark on C scale.
        - i. Read denominator as corresponding position under indicator on D scale.
      - b. If denominator is given, locate mark on D scale.
        - i. Read numerator as corresponding position under indicator on C scale.
  - B. Practice use of slide rule in solving proportions.
    - 1. Stress need to estimate size of missing term first.
    - 2. Students use demonstration rule at side of room.
- III. Introduction to graphing.
  - A. Introduce concept of ordered pairs of numbers as used in determining terms of equivalent fractions.
    - 1. Numerator, denominator.
  - B. Demonstrate, using graph paper, the use of Cartesian coordinates, for positive integers, in naming points in a surface.
    - 1. Use origin as a reference point.
    - 2. Use positive integers.
      - a. First number indicates distance to the right from the origin.
      - b. Second number indicates distance up.
  - C. Classwork and assignment:
    - 1. Construct graph of ordered pairs of numbers.
    - 2. Plot points for a set of equivalent fractions.
      - a. (Denominator, numerator) for each fraction.

Lesson 24

I. Review use of slide rule for proportions.

   A. Quiz: use of slide rule.

II. Graphing ordered pairs.

   A. Review homework.

   B. Construct axes with origin as reference point.
      1. Units of measure assigned.

   C. Stress order used in locating and naming point. (Right, up).
      1. (Denominator, numerator)

III. Classwork and assignment.

   A. Use slide rule to obtain a set of ordered pairs of numbers forming terms of a set of equivalent fractions.
      1. Examples:

         a. $\frac{X}{Y} = \frac{2}{5}$

         b. $\frac{X}{Y} = \frac{8}{12}$

      2. Plot points on graph.

Lesson 25

I. Solving proportions.

   A. Quiz and review use of slide rule.
      1. Use slide rule to solve a proportion.
      2. Plot four points on graph paper.

II. Graphing ordered pairs.

   A. Review of assignment.
      1. Note that points lie on a straight line.

III. Developing a set of ordered pairs of numbers from a linear equation.

   A. Use slide rule to find ordered pairs.
      1. Examples:

         a. $y = x$ b. $y = 2x$ c. $y = 3x$

IV. Classwork and assignment:

A. Find a set of ordered pairs of numbers from each equation, then plot points.

1. Examples:

a. $y = \frac{1}{2}x$

b. $y = \frac{x}{3}$

c. $y = \frac{3}{4}x$

d. $y = \frac{3}{2}x$

e. $y = 4x$

f. $y = 6x$

Lesson 26

I. Graphing ordered pairs of numbers.

A. Quiz and review of homework.

1. Find ordered pairs and graph for the equation $y = 5x$

B. Show that the set of points lie on a straight line.

II. Introduce concept of slope of a line.

A. Definition of slope as a ratio.

1. Illustrate by the process of moving in only an up-and-right direction (stepping).

III. Classwork: Find slopes of the lines for equation assigned yesterday.

1. Note comparison between "steepness" of line and size of numerical factor for slope.

IV. Assignment: Ditto Sheet.

A. Continue constructing graphs of ordered pairs and showing the slope of the line determined.

1. Use slide rule to determine points on the graph.

Lesson 27

I. Direct variation.

A. Review homework -illustrate the concept of the numerical value of slope.

a. from $y = ax$, a = slope, $\frac{y}{x} = a$

B. Direct variation.

1. Relate to $y = ax$.

a. Note $\frac{y}{x} = a$ where "a" is constant.

b. Definition of slope.

i. Relate to Range and Domain

ii. Formalize: Ratio of ordered pairs of replacements for variables is a constant.

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Lesson 26
Quiz

1. Find a set of 5 ordered pairs of numbers for the equation and plot the points. Use your slide rule.

$y = \frac{2}{3}x$

Name________________________________ Date______________

Lesson 26
Assignment

For each exercise find one ordered pair of numbers for the equation. Plot the points. Then, using the stepping process (right and up) locate other points which should lie on the line graph for the equation.

1. $y = \frac{1}{4}x$
2. $y = \frac{3}{10}x$
3. $y = \frac{3}{5}x$
4. $y = 5x$
5. $y = \frac{4}{3}x$
6. $y = \frac{6}{5}x$

II. Indirect variation.

- A. Graph xy = 1.
- B. Classwork: Ditto sheet.
  - 1. Use C and D scales to obtain ordered pairs.
- C. Assignment: First half of ditto sheet.

Lesson 28

I. Graph to illustrate direct and inverse variation.

- A. Quiz: Graph: 1. y/x = 1 2. xy = 1
- B. Review quiz
  - 1. Discuss graphs of above.
- C. Review homework.
- D. Classwork: Continue ditto sheet.
  - 1. Direct and inverse variation using slide rule.
- E. Assignment: Complete ditto sheet.

Lesson 29

I. Graph and illustrate direct and inverse variation.

- A. Review homework
- B. Direct variation--linear graph.
- C. Inverse variation--hyperbola.
  - 1. Compare to linear graph.
  - 2. Properties of points on graph.
- D. Determining whether function is a direct or inverse variation.
  - 1. Examine: D = R x T
    - a. Let R (rate) be constant, graph D = R x T
      - i. Determine whether the set of ordered pairs is an example of direct or inverse variation.
    - b. Let D (distance) be constant, graph D = R x T
      - i. Determine whether direct or inverse variation.

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Lesson 27
Assignment

For each exercise find eight ordered pairs of numbers which satisfy the given equation, then plot the pairs indicated by the ordered pairs. Draw a smooth curve through the points to indicate other points on the graph of the equation.

1. $xy = 16$

2. $xy = 12$

3. $\frac{x}{y} = .1$

4. $xy = 24$

5. $xy = 18$

6. $xy = 1.2$

7. $\frac{x}{y} = .8$

8. $xy = 4.5$

9. $xy = 6.5$

10. $xy = 12.8$

11. $xy = .8$

12. $\frac{x}{y} = 2.4$

c. Examine form of function of parts "a" and "b" above.

F. Classwork: Ditto sheet on problems involving direct and inverse variation. Determine type of graph.

G. Assignment: Complete ditto sheet.

Lesson 30

I. Graphing direct and inverse variation.

A. Review of Direct and Inverse variation.

1. Use example $D = \frac{W}{V}$ (Density $= \frac{\text{weight}}{\text{volume}}$)

B. Review homework

1. Review graphing

C. Review for test

D. Assignment: Study for test

Lesson 31

I. Test on Ditto Sheet.

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Lesson 29
Classwork and Assignment

For each exercise is a statement or statements giving a relationship between two variables. Identify the variables and the type of variation as "direct variation", "inverse variation", or "other".

1. I can drive that distance in 3 hours at 40 m.p.h. but Bill can drive it in 2 hours at 60 m.p.h.

2. We can drive the distance in 8 hours at 50 m.p.h. or we can fly there in 2 hours at 200 m.p.h.

3. Two men can paint the house in 12 days, but three men require only eight days.

4. Ten men can accomplish twice as much work, in a given amount of time, as five men.

5. I can travel three times as far at 60 m.p.h. as I can in the same time at 30 m.p.h.

6. I can travel twice as far in eight hours at 60 m.p.h. as I can in four hours at the same speed.

7. When cloth material is cut from a bolt of material we find that if a 3-foot length is cut off, the piece contains 9 sq. ft. If a 6-foot length is cut off, the piece contains 18 sq. ft.

8. $C = \pi d$

9. $C = 2\pi r$

10. $A = lw$

11. $A = \pi R^2$

12. $64 = lw$

13. $A = \frac{1}{2} b(.3)$

14. $C = .05 \cdot \ell$

15. $N = 28n$

16. $b \cdot c = 35$

17. $\frac{k}{m} = 15$

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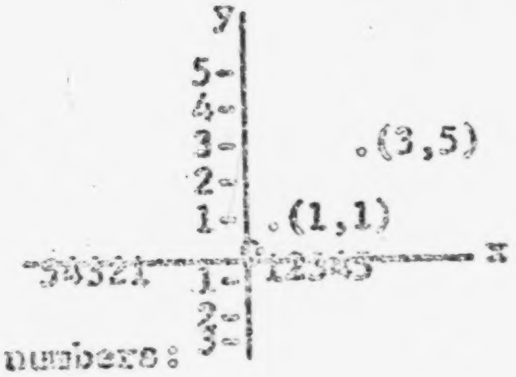
Lesson 31
Introduction to Algebra

I. Test



A. 1. Find Slope

2. Find Slope: $y = \frac{3}{5}x$

B. Graph: the ordered pairs of numbers:

1. $(\frac{1}{2}, 2)$ 3. $(0, 4)$

2. $(2, \frac{1}{2})$ 4. $(5, 1)$

C. Graph the following equation:

1. $y = 10x$

D. Is the following a proportion? (Show how you obtained your answer.)

1. $\frac{3}{7} = \frac{27}{65}$

E. Given: Area of a rectangle = length X width or A = LW

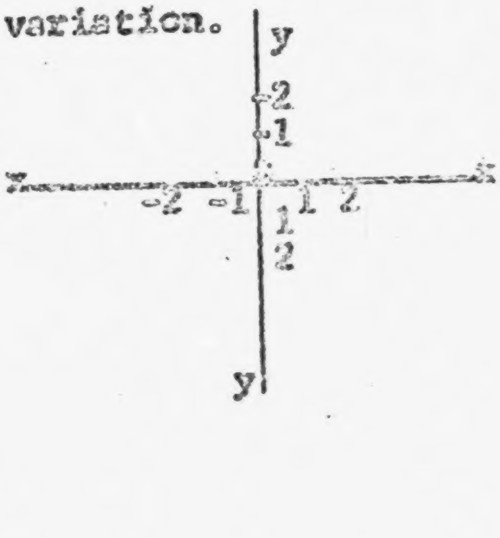
1. If A is constant and equal to 36, graph A = LW or 36 = LW.

2. Is 1 above divert or inverse variation.

3. If L is constant and equal to 1, graph A = LW or A = 1 x W.

4. Is 3 above divert or inverse variation.

F. Give an example of how the graph for inverse variation would look on the following pair of axis.



Lesson 32

I. Review of trigonometric ratios.

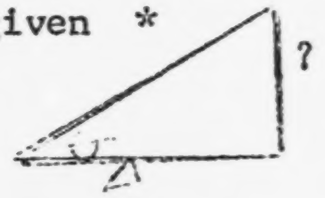
- A. Similar right triangles.
  - 1. Ratio of sides: a constant
  - 2. Classwork development of the tangent function.
    - a. On graph paper
      - i. Construct three similar right triangles.
      - ii. Compare by measurement the length of the legs of each triangle, side opposite one angle to the side adjacent to the same angle.
  - 3. Review the six basic functions.
- B. Trigonometric tables.
  - 1. Review method of reading tables.
- C. Classwork: Solve problems involving trigonometric ratics. (Ditto Sheet)
  - 1. Using knowledge of trigonometric ratios, estimate the length of sides sought.

Lesson 33

I. Review test

II. Review of trigonometric functions

- A. Quiz: (1) given *



$\sin\theta = --$

$\cos\theta = --$

$\tan\theta = --$

- B. Review of reciprocal functions.
  - 1. sin $\theta \rightarrow$ esc θ
  - 2. cos $\theta \rightarrow$ sec θ
  - 3. tan $\theta \rightarrow$ ctn θ
  - 4. Review choosing correct function for solving problem.
    - a. List known facts.
    - b. List unknown quantity to be found.
    - c. Determine necessary function.
      - i. Choose function where unknown quantity is in numerator.
    - d. Solve

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Lesson 32 Classwork

For exercises 1-10 find the trigonometric function of the angle given.

1. Tan 32° = ________
2. Cos 25° = ________
3. Sin 65° = ________
4. Ctn 45° = ________
5. Tan 72° = ________
6. Sin 37° = ________
7. Csc 17° = ________
8. Cos 53° = ________
9. Tan 14° = ________
10. Ctn 22° = ________

For exercises 11-20 using a compass construct a right triangle having leg b 100 mm (10cm) long. The other leg or hypotenuse must be of appropriate length to give the trigonometric ratio given in the problem. Check your work by measuring the angle A and checking with your trigonometric tables.

11. Tan A = 1.0
12. Sin A = .89
13. Tan A = .31
14. Cos B = .71
15. Tan A = 0.6
16. Sin A = .81
17. Tan A = 1.6
18. Sin A = .27
19. Sin A = .95
20. Cos B = .95

For exercises 21-30 use your trigonometric tables to estimate the length of the sides of the right triangle ABC based on the given information.

21. A = 30°; a = 12 cm
22. A = 60°; a = 35 cm
23. A = 25°; c = 12 cm
24. A = 75°; a = 55 cm
25. A = 35°; c = 85 cm
26. B = 65°; a = 14 cm
27. B = 55°; a = 25 cm
28. B = 80°; b = 50 cm
29. B = 15°; b = 12 cm
30. B = 52°; b = 42 cm

C. Review homework.

D. Classwork and assignment: Continue ditto sheet.

Lesson 34

I. Review of trigonometric functions.

A. Quiz: Write reciprocals of the following functions.

B. Review homework.

1. Pupils analyze and set up each word problem on board.

2. Stress need for memorizing six trigonometric functions.

C. If time, classwork and setting up word problems involving trigonometric problems (ditto sheet)

1. Using knowledge of trigonometric ratios, estimate the length of side sought.

D. Assignment: Complete setting up word problems.

(Do not solve).

Lesson 35

I. Introduction to use of slide rule for the sine function.

A. Demonstrate the S scale on the slide rule.
    1. Explain that numerals represent the measure of angles from 1° to 90°.
    2. Explain the relation between S and A scales.
        a. Read "30" on S scale line up indicator, read "5" on A scale. This reading should be ".5".
    3. Explain that all markings on A scale must represent values from 0.1 to 1.0 when reading from S scale.
    4. Have students practice reading values.
        a. Example: find sine 45°.
    5. Have students read the angle corresponding to a given function.
    6. Have students compare slide rule scale with the sine function in their trigonometric tables.
    7. Explain the division on the S scale.
        a. Consider that there are 60 spaces between marks for consecutive integers.
    8. Classwork: Ditto sheet
        a. Practice in reading the S and A scales
        b. Solving right triangles with calculation with slide rule.

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Lesson 34

Quiz; Write the reciprocal of each function.

1. Cos θ = 2. Ctn θ = 3. Csc θ =

Classwork and Assignment:

For exercise 1-10: using a compass and straight edge construct a right triangle ABC having leg b of length 100 mm (10cm). The other leg or hypotenuse must be of appropriate length to give the trigonometric ratio given in the problem. Check your work by measuring the angle A and checking with your trigonometric tables.

1. Tan A = .8
2. Sin A = .15
3. Cos B = .76
4. Tan A = 1.1
5. Sin A = .99
6. Cos B = .98
7. Tan A = .23
8. Sin A = .40
9. Cos B = .80
10. Tan A = 2.9

For exercises 11-20 use your trigonometric tables to estimate the length of the sides of the right triangle ABC based on the given information.

11. $A = 30^\circ$ $a = 17$cm
12. $A = 50^\circ$ $a = 20$cm
13. $A = 25^\circ$ $b = 12$cm
14. $A = 56^\circ$ $b = 20$cm
15. $A = 70^\circ$ $c = 30$cm
16. $A = 35^\circ$ $c = 40$cm
17. $A = 50^\circ$ $a = 20$cm
18. $A = 65^\circ$ $b = 50$cm
19. $A = 40^\circ$ $c = 30$cm
20. $A = 65^\circ$ $c = 60$cm

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[illegible] of [illegible]

[illegible] problems 21-25 solve the problems by making a sketch, labeling the [illegible] conditions, and indicating the function used.

21. In right triangle [illegible] angle N measures 35° and side LM is 12cm. Find the side [illegible] if angle L is a right angle.

22. In right triangle XYZ angle Z measures 68° and side XY is 35cm. Find side YZ if angle X is 90°.

23. In right triangle ABC angle C is a right angle. Angle A measures [illegible]° and side AC is 25cm. Find the length of side AB.

24. In right triangle XYZ angle Y is a right angle. Angle Z measures [illegible]° and side YZ measures [illegible]cm. Find the length of side XZ.

25. In right triangle ABC angle B is a right angle. Side BC measures [illegible] and angle C measures 28°. Find the length of side AC.

Lesson 35 (continued)

II. Explain the division on the A and B scales.

A. Consider the scale to read from .01 to 1.0.
   1. or 1 to 100
   2. or .0001 to .01

B. Show relation (squares) of A scale to the D scale.
   1. Consider there are 100 spaces between marks for consecutive intergers.

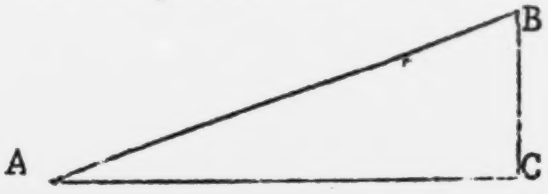
C. Classwork: Practice in reading S, B, and A scales.

III. Explain application of slide rule to solution of missing dimensions of right triangle.
   1. Review algebraic solution.
      a. example: in triangle ABC

$\angle A = 30^\circ$, $\angle C = 90^\circ$, $c = 5''$, find a.

i. Solution:
$\text{sine } 30^\circ = \frac{a}{5}$

$5 \text{ sine } 30^\circ = a$



   2. Show how to evaluate "5 sine 30°" using the S, B, and A scales.
      a. estimate size of side a
      b. locate "30" on S scale
         i. place indicator on mark for 30.
      c. slide right end of B scale under indicator
      d. holding the slide in place, move indicator to the mark for "5" near the B scale.
      e. Read "25" on A scale. This must be considered as 2.5 in this situation.

IV. Classwork and Assignment:

A. Complete ditto sheet.
   1. Reading markings on scale.
   2. Evaluating expressions involved with sine functions.

Lesson 36

I. Sine and cosine functions using the slide rule.

A. Review homework.
   1. Stress estimation
   2. Stress scale divisions on S and A scales

B. Quiz on:
   1. Reading scales,
   2. Evaluating expression with sine function.

I

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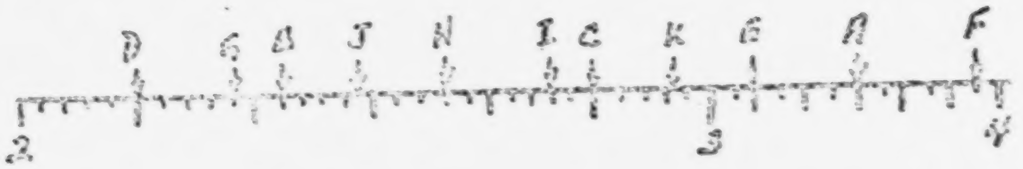
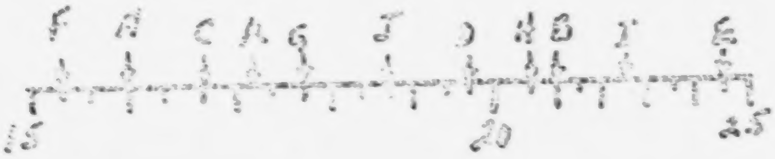
Lesson 35
Classwork

S scale graduations

Section I

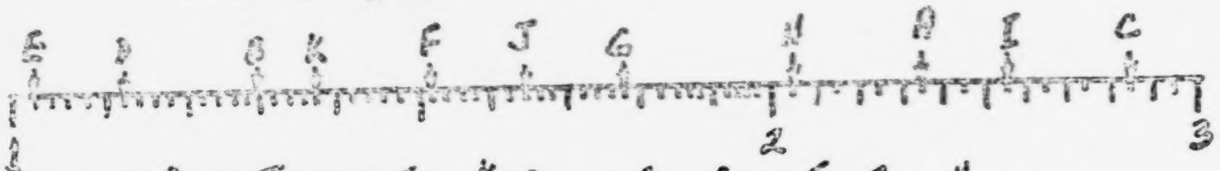


Section II

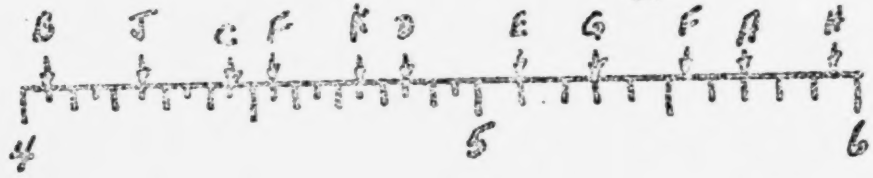


B scale graduations

Section III



Section IV



Next to each letter write the number represented by the scale marking indicated by that letter in each Section above

Point	Section I	Section II	Section III	Section IV
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				

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Lesson 35

Classwork and Assignment:

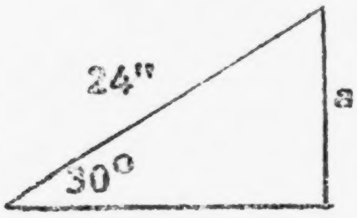
For each exercise use your slide rule to evaluate the given expression.

1. $3 \sin 45^\circ$
2. $12 \sin 30^\circ$
3. $25 \sin 20^\circ$
4. $.40 \sin 60^\circ$
5. $.80 \sin 30^\circ$
6. $2.8 \sin 60^\circ$
7. $.55 \sin 20^\circ$
8. $.18 \sin 30^\circ$
9. $.24 \sin 50^\circ$
10. $1.5 \sin 35^\circ$

For each exercise:

A. set up an equation,
B. solve the equation for the variable,
C. use your slide rule to evaluate the resulting expression.

1.



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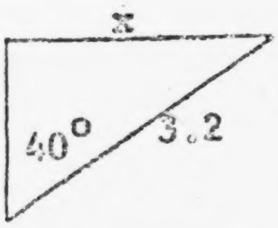

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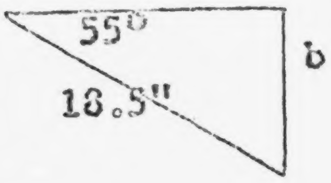

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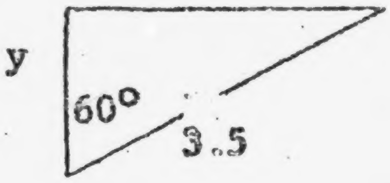

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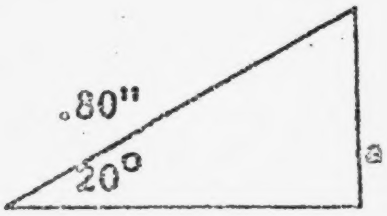

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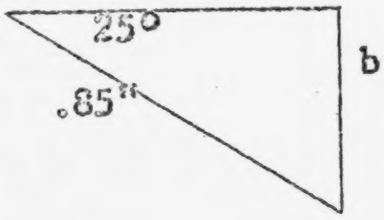

I.

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Lesson 36

Classwork and assignment.

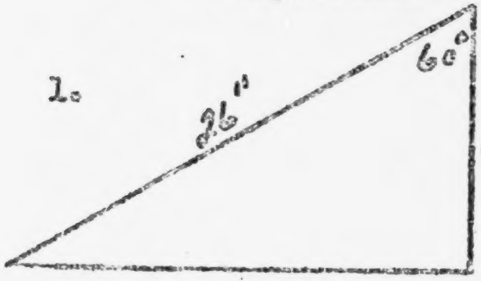
For each exercise use your slide rule to evaluate the given expression.

1. 5 cos 45°	6. 3.8 cos 50°
2. 15 cos 30°	7. .65 sin 30°
3. 35 cos 18°	8. .25 cos 30°
4. .4 cos 60°	9. .75 cos 40°
5. .8 cos 30°	10. 1.5 cos 35°

For each exercise:

A. Set us an equation,
B. Solve the equation for the variable,
C. Use your slide rule to evaluate the resulting expression.

1.



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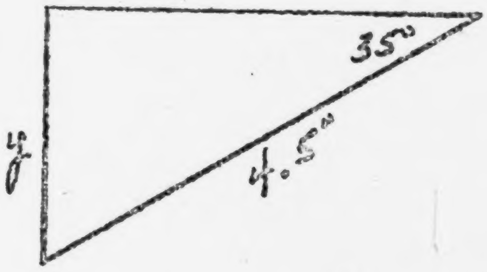

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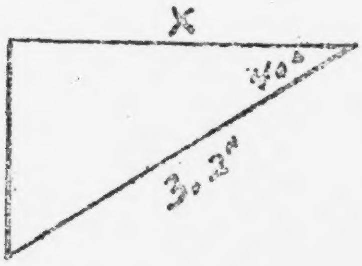

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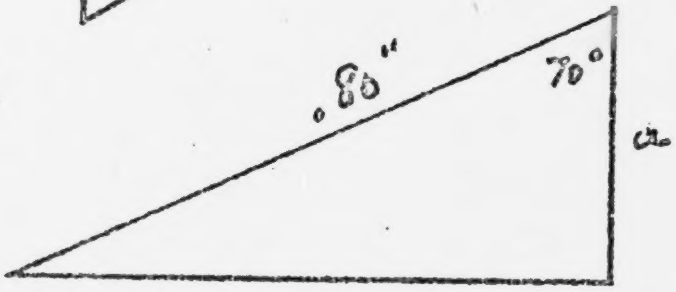

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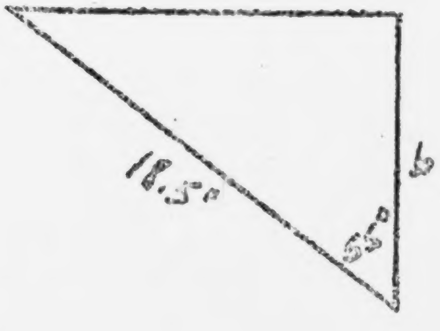

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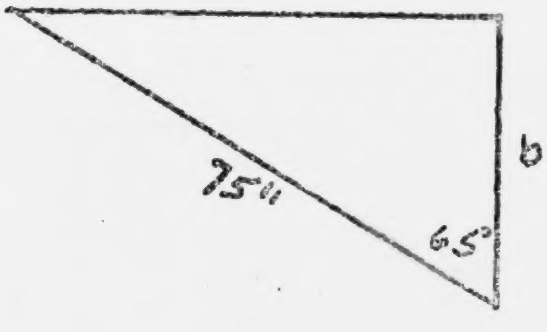

Z

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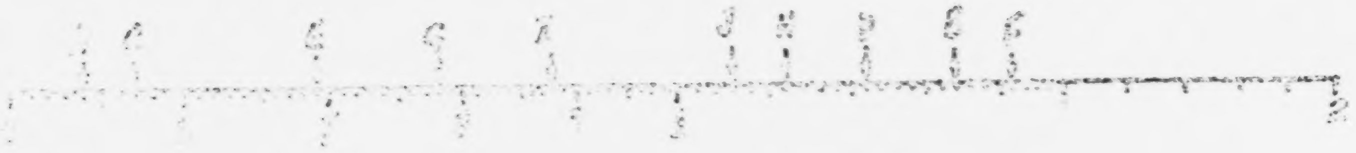
Lesson 36

Classwork

Section of D Scale



For each exercise complete the statement:

1. If point A is read 5.____, then point J is read _____.

2. If point E is read .06____, then point H is read _____.

3. If point C is read .05____, then point D is read ______.

4. If point G is read 7.____, then point F is read ____.

5. If point I is read .0____, then point [illegible] is read _____.

For each exercise solve the problem. Do the calculations using your slide rule.

1. 7 cos 20°
2. 15 cos 45°
3. 3.5 cos 35°
4. 2.7 cos 65°
5. 2.5 cos 38°
6. 4.5 cos 42°

C. Introduce use of S scale for cosine function.
   1. Review that the cosine of an angle is the same as the sine of the complimentory angle:

      $\cos \theta = \sin (90 - \theta)$

   2. Practice finding compliments of angles.

II. Classwork (ditto sheet)

A. Reading scales: S and A

B. Evaluating expressions
   1. Involving sine or cosine function.

INTRODUCTION TO VECTORS

Lesson 1

I. Vectors/direction

A. Review Ray

1. Examples of rays.
2. Definition of rays.
3. Symbol used to designate rays.
4. A — — B → written as $\overrightarrow{AB}$.

   and B — — A → written as $\overrightarrow{BA}$.

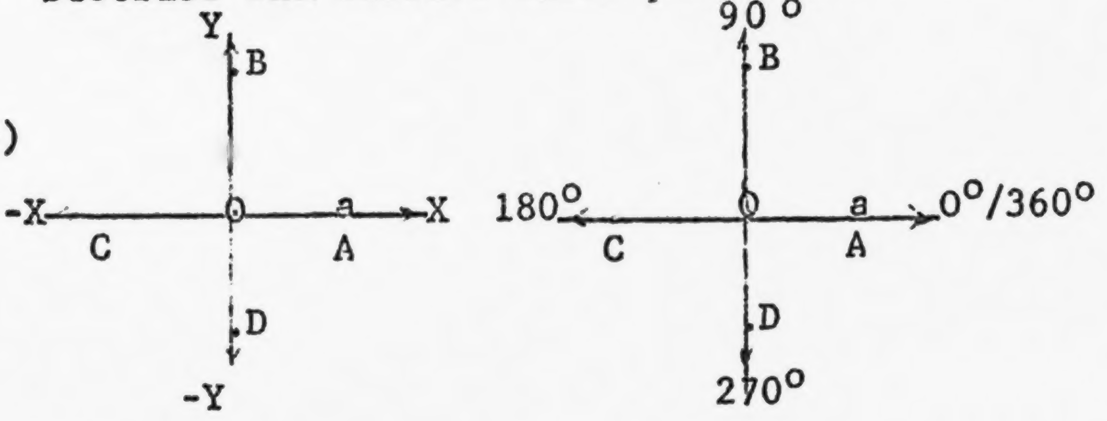
   a. Stress order of reading.

   b. Note: $\overrightarrow{AB} \neq \overrightarrow{BA}$

B. Develop concept of a vector.

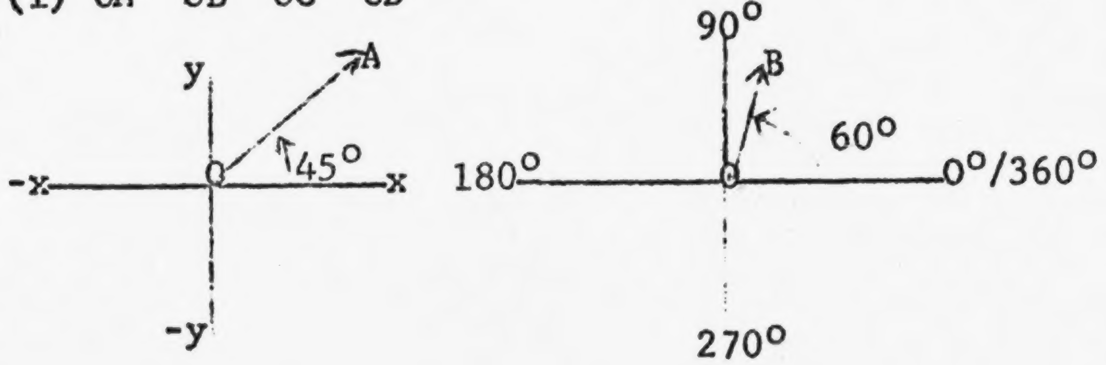
1. On coordinate axes, draw sets of four rays. Describe and discuss their positions.

(a)



(i) $\overline{OA}$ $\overline{OB}$ $\overline{OC}$ $\overline{OD}$

(b)



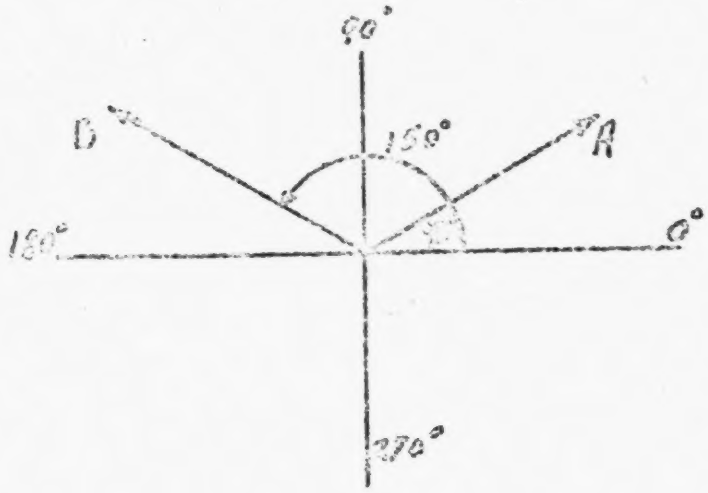
(i) Position of $\overrightarrow{OA}$ and $\overrightarrow{OB}$ determined by angle.

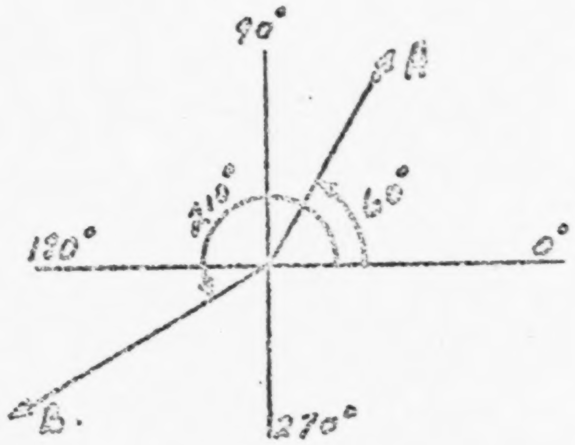
(ii) Ray OA has the origin as its endpoint and is positioned by the 45° angle.

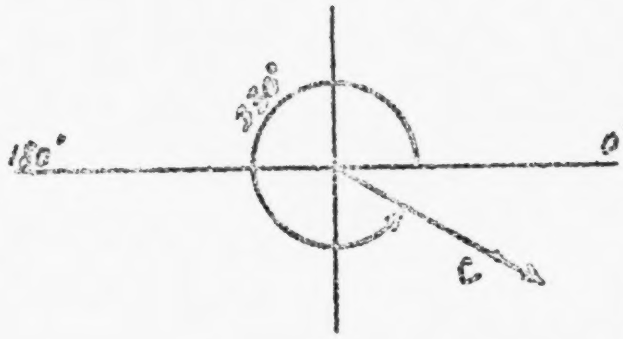
(iii) How is ray OB determined or described?

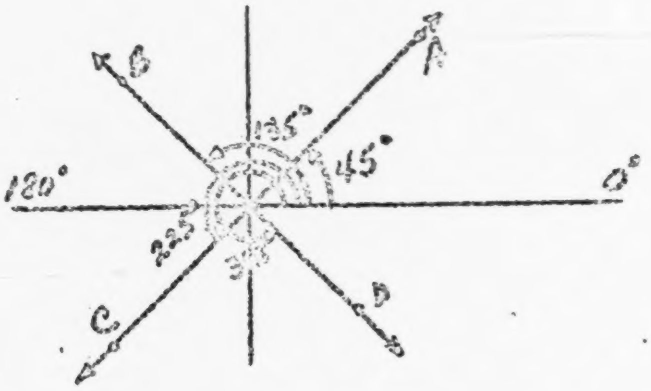
Lesson 1
Classwork and Assignment

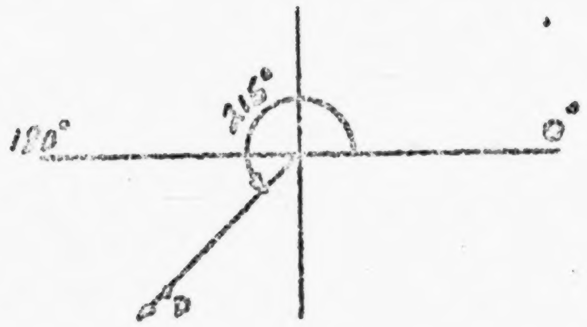
A. Describe the positioning of the rays on each of the following diagrams.

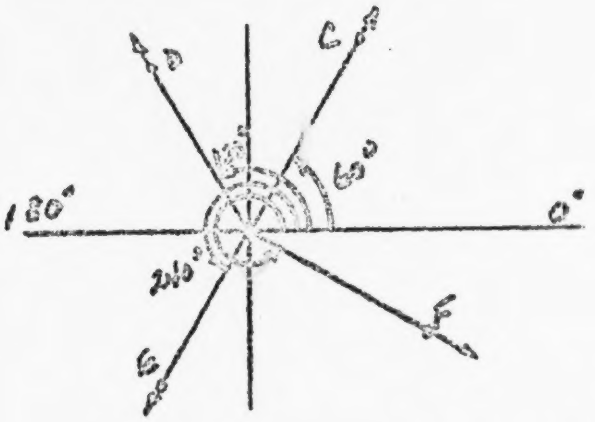












B. Construct each ray on coordinate axes following the description given.
1. OA, endpoint O at the origin and its direction determined by a 20° angle.
2. OB, endpoint O at the origin and its direction determined by an 80° angle.
3. OC, endpoint O at the origin and its direction determined by an angle of 120°.
4. OD, endpoint O at the origin and its direction determined by an angle of 160°.
5. OE, endpoint O at the origin and its direction determined by an angle of 300°.

Lesson 1 (continued)

C. Classwork: ditto sheet
  1. Describe the positioning of the rays on each of the following diagrams.
  2. Construct each ray on coordinate axes following the description given.

D. Assignment
  1. Complete ditto sheet according to instructions. (repeat C and D of above.)

Lesson 2

I. Review homework: Vectors/direction.
  1. Identify each ray by name and direction.

II. Vectors/Magnitude

A. Graph the ordered pairs of numbers: A (0,0) and B (3,4)
  1. Draw line segment AB.
  2. Determine length of line segment AB.
    i. Distance formula by the pythagorean theorem.
  3. Determine angular direction.
    i. Apply trigonometric functions.

B. Vectors
  1. Quantities requiring both direction and magnitude.

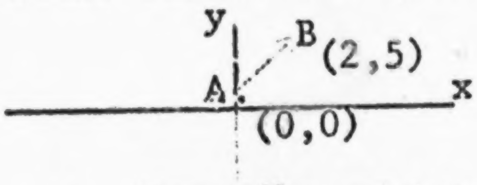
    a. The pictorial (graphic) representation of a vector is done in two ways:
      i. Direction by the direction of the arrow.
      ii. Magnitude by the length of the arrow.

C. Scaler quantities
  1. Quantities requiring only magnitude; examples:
    a. Length of a table.
    b. Mass of an object.

  2. Compare scaler quantities to vector quantities.

D. Determine the vector quantity for the given vector:

  1.



    a. Describe vector AB.
    b. Find length of AB by forming a right triangle.
    c. Find angular direction by tangent function.

E. Classwork: Find the vector quantities for the following vectors (Ditto Sheet)

F. Assignment: Complete ditto sheet.

Name________________________________ Date_______________

Lesson 2
Classwork and assignment

Find the vector quantities for each of the given vectors.

$\longrightarrow$

1. C(0,0) D(5,5)
2. A(0,0) B(3,4)
3. D(0,0) E(4,3)
4. A(0,0) B(-4,3)
5. M(0,0) N(-3,4)

$\longrightarrow$

6. L(0,0) P(6,8)
7. A(0,0) C(16,12)
8. D(0,0) G(-8,6)
9. F(0,0) B(20,15)
10. S(0,0) T(-12,16)

$\longrightarrow$

11. X(0,0) Y(5,-10)
12. R(0,0) S(-5,10)
13. A(0,0) B(4,10)
14. C(0,0) D(-4,-8)
15. K(0,0) L(-8,-4)

$\longrightarrow$

16. A(0,0) C(1,10)
17. D(0,0) B(-3,5)
18. E(0,0) G(8,-2)
19. M(0,0) N(5,-4)
20. T(0,0) R(7,-1)

Lesson 3

I. Quiz: Determine vector quantity of vector AB.

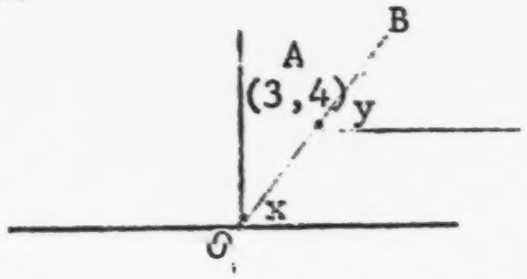
II. Review definitions scalar quantities and vector quantities.

III. Review Homework.

IV. Determine vector quantity for vector.AB.

A (3,4) B (6,8) $\overrightarrow{(A\ (3,4)\ \ B\ (6,8))}$

A. Construct right triangle.
  1. Find length of vector.
  2. Extend hypotenuse BA through point A to x-axis.
  3. Drop perpendicular from B(5,7) to x-axis.
  . Note the similar right triangles.
    a. Example:



    b. Compare angle X to angle Y.
    c. Vector quantity of vector AB is the magnitude (length of AB) and size of $\angle$ Y.

B. Classwork: Determine vector quantities for the following vectors determined by the given ordered pairs of numbers (ditto sheet).

C. Assignment: Complete first 10 problems on ditto sheet.

Lesson 4

I. Quiz (Determine the vector quantity of A (4,3) B (8,6).

II. Review of vector and scalar quantities in homework.

III. Equivalent vectors

A. Vectors having the same magnitude and direction are equivalent vectors.
  1. Find vector quantity of A (0,0) B (5,5)
  2. Find vector quantity of C (3,3) D (8,8)
  3. Compare vector quantity of AB to CD.
    (i) Satisfies definitions of equivalent vectors.

B. Classwork on equivalent vectors (on previous ditto ditet #11-20)

C. Assignment: Complete ditto sheet.

Lesson 3
Classwork and Assignment

Determine the vector quantity for each of the vectors determined by the given set of ordered pairs.

1. A(7,5) B(4,1)
2. C(12,7) D(9,3)
3. F(3,5) E(9,13)
4. R(6,2) S(12,10)
5. K(2,9) L(-1,5)
6. M(7,7) N(4,3)
7. B(-7,-6) A(-1,2)
8. D(-5,2) C(1,10)
9. R(-1,-6) S(10,6)
10. T(1,-4) U(10,11)

11. X(5,7) Y(8,11)
12. B(-2,-7) A(1,-3)
13. C(-8,-9) D(-18,-19)
14. K(-9,1) L(-19,-10)
15. N(-7,-2) M(-10,2)
16. Q(1,3) R(-2,7)
17. T(0,1) X(5,7)
18. Y(8,11) Z(13,17)
19. Q(1,3) C(-8,-9)
20. L(-19,-10) M(-10,2)

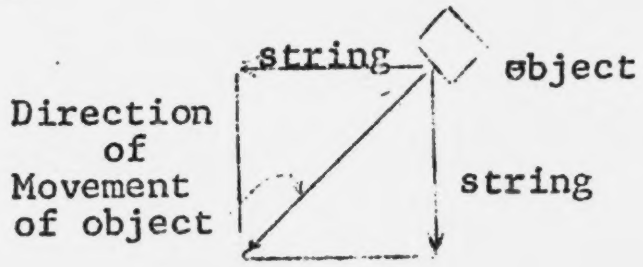
Lesson 5

I. Quiz (Locate the point B(x,y) so that $\overrightarrow{A(0,0)\,B(x,y)} =$
$\overrightarrow{C(1,2)\,D(5,7)}$

II. Resultant force of two forces acting at a point.

A. Parallel forces: Examples for consideration.
  1. Moving an object with a force of 100 lbs.
    a. A second force of 50 lbs. is also exerted in the same direction.
    b. Total force of 150 lbs. in the same direction.
  2. Moving an object with a force of 100 lbs.
    a. A second force of 25 lbs. is also exerted in the opposite direction.
    b. Total force moving object is 75 lbs. in the direction of the 100 lb. force.
  3. A plane traveling east at 300 m.p.h. has a tail wind of 80 m.p.h.
    a. How fast is the plane traveling and in which direction?
  4. Summary
    a. Parallel forces acting in same direction, add forces to get the resultant force.
    b. Parallel forces acting in opposite directions, subtract forces to get the resultant force.

B. Forces acting at right angles.
  1. Demonstrate pulling an object attached to a string.
    a. The object moves in the same direction as the force being applied.
  2. Attach 2 strings of equal length to the object.
    a. Apply equal forces on the strings at right angles. (Form a square in relation to object and endpoints.)
    b. Object moves along the diagonal.
    c. Example:



  3. Picture above demonstration with vector.

    a. Draw a vector equivalent to OB starting from point A. (OB'= AB')

Name________________________________ Date________________

Lesson 5
Classwork and Assignment

For each exercise

A. Study the problem thoroughly.

B. On graph paper draw vectors to represent the motions indicated in the problem.

C. Find the distance by measuring the resultant vector on the graph.

1. A boy walks north 30 yards and then walks east 40 yards. How far is he from his starting point?

2. Two boys walk south 12 blocks and then west 5 blocks. On a map of the city, what is the direct-line distance from their starting point to the place where they stopped? (Assume that all city "blocks" are square in shape.)

3. An airplane flew west 150 miles and then 120 miles south. What is the straight line distance between his starting and finishing points?

4. A motor boat traveled south 3 miles on a lake and then east 5 miles. If the boat had taken a straight course to its destination, how far would it have traveled?

5. A train traveled south from Chicago for 300 miles and then traveled west and traveled 400 miles west. Assuming the surface of the earth is flat, what is the straight-line distance between the starting and finishing points.

6. A fly, walking along the ceiling, traveled 20 cm. north and then 15 cm. east. What is the straight-line distance between its starting and finishing points?

7. A snail, crawling along a cellar floor, travels 12 cm. east and then 9 cm. north. What is the straight-line distance from its starting to finishing points?

8. Two men pushed a large machine lathe nine feet south and 5 feet east. What is the straight-line distance between their starting and finishing points.

b. Observe the forces of OB and OA on the object at point O are equivalent to the forces OA and AB on the object at point O.
  i. The forces terminate at point B'.
  ii. OB is the resultant force of OA + OB.

4. Classwork problem. A boy walks north 30 yards and then walks east 40 yards. How far is he from his starting point?

C. Classwork: Problems on resultant of 2 vectors. (Ditto sheet)

D. Assignment: Complete 1 to 5 on ditto sheet. Test tomorrow.

Lesson 6

I. Test: (Close out marking pd.)

Lesson 7

I. Equivalent vectors.

  A. Quiz

  B. Equivalent vectors.

    1. Null vectors.
      a. Definition
      b. Result addition of 2 vectors equal in magnitude and opposite in direction.
      c. All null vectors are equivalent.

  C. Classwork:
    1. Word problems involving addition of vectors.
      a. Graphical solution.

  D. Assignment: Ditto sheet on word problems.

Lesson 8

I. Review of equivalent vectors and null vectors from homework.

  A. Graphical solution of word problems involving vectors.
    1. Approximation

  B. Calculating vector problems.
    1. Resultant of 2 forces.
    2. Resultant of 3 or more forces.

Name______________________________ Date______________

Lesson 6 Quiz

1. Show graphically the single vector to represent this combination of trips?

Two men move a machine 8 feet south and 12 feet west. What is the straight-line distance between their starting and finishing points?

2. Below are listed five vectors. Which vector is equivalent to A(7,5) B(10,10)?

X(5,7) Y(10,10)   Z(4,3) R(7,7)

K(-2,-3) L(3,0)   T(6,4) U(9,3)

M(-3,-2) N(0,3)

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Lesson 6
Classwork and Assignment

For each exercise determine the distance and bearing from the starting point to the ending point.

a) Graphically, and
b) By calculation, using the Pythagorean Theorem.

1. A cyclist drives 30 miles north and then 25 miles west.

2. A Mercedes is driven 200 km. on a bearing of 90° and then turns and drives at a bearing of 0° for another 100 km.

3. A man walks 6.0 km. on a bearing of S 20° E; then turns and walks N 70° E a distance of 9.0 km.

4. A motor boat starts on a bearing of N 45° W and travels 150.0 meters. It then turns and travels 360.0 meters on a S 45° W bearing.

5. A man making deliveries from his store traveled 5 blocks west, then 3 blocks north, 7 blocks east, 1 block north, 3 blocks west, and finally 2 blocks north. (Assume that all city blocks are square.)

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Lesson 7
Classwork and Assignment.

For each exercise draw on graph paper the indicated vectors. Use your drawing to answer the question in the exercise.

1. A man walks 9 meters in a direction of N 60° E and then turns and walks East for 3 meters. Give the direction and distance from his starting point to his finishing point.

2. A man walks 12 meters in a westerly direction and then 9 meters in a northerly direction. Give the direction and distance from his starting point to his finishing point.

3. A man walks 8 meters in a direction S 60° E and then walks N 60° E for 8 meters. Find the direction and distance from his starting point to his finishing point.

4. A man walks 9 meters in a direction W 30° S and then 6 meters in a direction N 60° W. Find the direction and distance from his starting point to his finishing point.

5. A man walks 8 meters in a direction S 60° W, then 8 meters in a direction W 30° S. Then 12 meters in a direction E 60° N Find the distance and direction from his starting point to his finishing point.

6. A man walks 8 meters in a direction W 60° S, then 8 meters in a northerly direction, then 8 meters E 30° S. Find the distance and direction from his starting point to his finishing point.

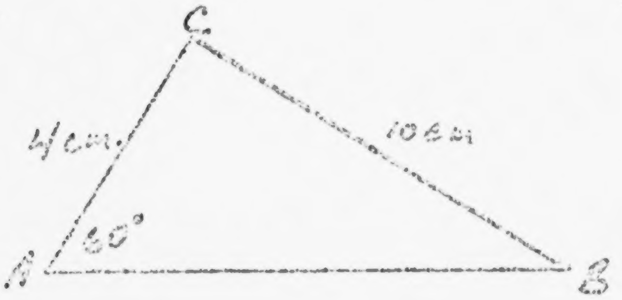
7. A man walked 9 meters in a direction E 45° N, then 9 meters in a direction E 45° S, and then 12.73 meters West. Find the distance and direction from his starting point to his finishing point.

Name____________________________________ Date__________________

Lesson 8
Classwork and Assignment

Using the Law of Sines, find the missing parts of each given triangle. Note that these drawings are not to scale.

1.



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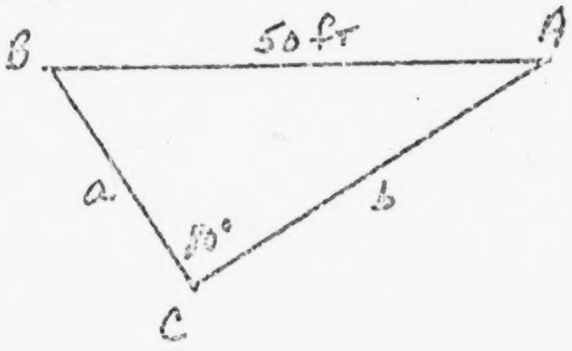

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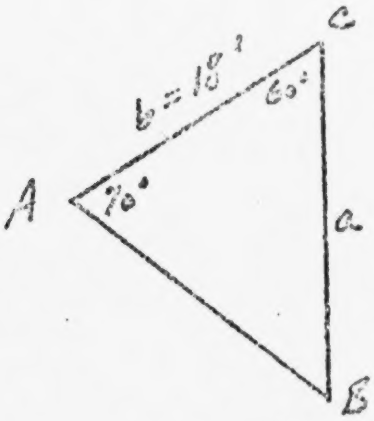
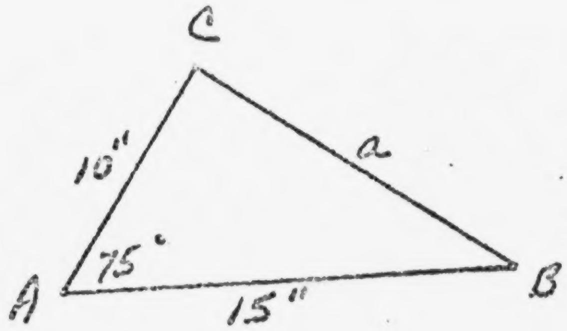


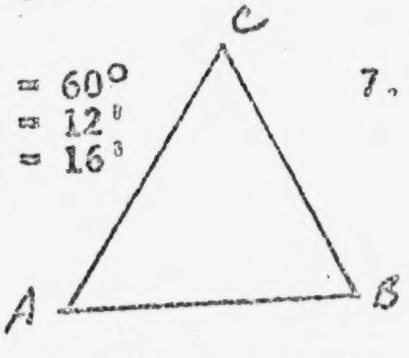
4.



5. In triangle ABC, angle A measures 65°, angle B measures 35°, and side a measures 18mm.

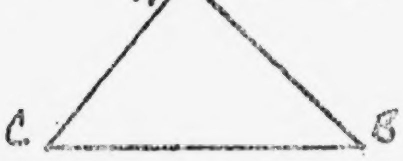
Using the Law of Cosines, find the missing side in each given triangle.

6. Given: ∠A = 60°
b = 12"
c = 16"

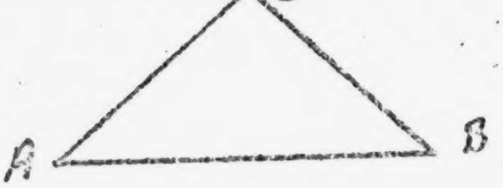


7. Given: ∠x = 30°, y = 15cm, z = 1

8. Given: ∠C = 60°, a = 10"
b = 10"



9. Given: ∠B = 40°, c = 20mm, a = 1



10. In triangle ABC angle A = 78°, angle B = 54°, side c = 24m.

11. In triangle KLM angle K measures 48°, side KL measures 24mm, and side KM measures 32mm.

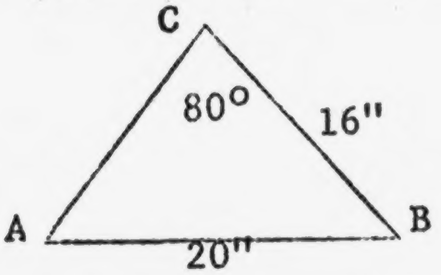
12. In triangle ABC angle C measures 52°, side BC measures 15cm. and side AC measures 21 cm.

Lesson 8 (continued)

II. Law of Sines

A. Purpose:
   1. A means of determining the measure of parts of a triangles, regardless of its shape.

B. Review of proportions.
   1. Method of calculating for unknown.
      a. Review familiar techniques learned in the ratio and proportion unit.
      b. Review use of slide rule: A and B scales.
   2. Examples for analysis:
      a. Find all parts of given triangle:



         i. Review labeling vertices and sides of a triangle.

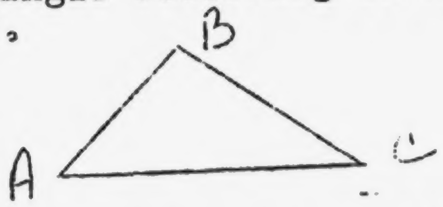
C. Classwork: review problem on board.
   1. Law of Sines

D. Assignment: Complete 1 to 5 on ditto sheet.

Lesson 9

I. Law of Sines (acute angles)

A. Quiz
   1. Label sides of triangle according to names attached to vertices.



   2. Write the Law of Sines for the triangle in problem 1.

B. Review quiz.

C. Review homework problems.
   1. Examine homework problem #4.
      a. Can't find solution.
      b. Need more information.

Lesson 9 (continued)

D. Law of Cosines (acute angles)
  1. Number of unknowns in the Law.
    a. Three forms of law.
      i. To find missing side.
      ii. To find missing angle.
  2. Classwork: Find solution to problem #4 of last nights assignment.
    a. Complete solution of Law of Sines.
  3. Determining method of solution for a given problem.
    a. Need a drawing to determine the techniques of solutions.

E. If time, classwork on Law of Cosines. Ditto sheet problems 6,7, and 8.

F. Assignment: Complete 6,7, and 8 on ditto sheet.

Lesson 10

I. Law of Sines/Law of Cosines

A. Quiz.

B. Review quiz.

C. Classwork: Continue ditto sheet. (9,10,11, and 12)

D. Assignment: Complete ditto sheet.

Lesson 11

I. Trigonometry functions of obtuse angles.

A. Review definition of an obtuse angle.
  1. Show location of an obtuse angle on the coordinate plane. (Use unit circle.)

B. Reference angle.
  1. Let θ be reference angle.
    a. Define $(180^\circ - \theta)$
    b. Locate on graph $(180^\circ - \theta)$ where $\theta = 30^\circ$.
      i. $\theta = 45^\circ$
      ii. $\theta = 60^\circ$
    c. Discuss location for any angle $(180^\circ - \theta)$ where $0^\circ < \theta < 90^\circ$.

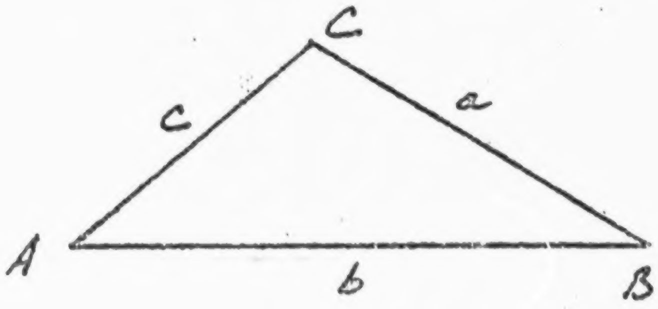
Name_______________ Date_______________

Lesson 10
Quiz

1. Given: $\angle A = 30°$

$\angle B = 25°$

a = 30 inches
Find b.

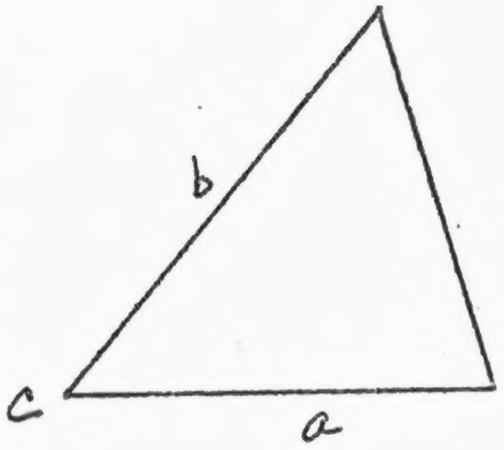


2. Given: $\angle C = 70°$

a = 18 inches

b = 20 inches

Find c.



Lesson 11 (continued)

C. Trigonometric functions of any obtuse angle.
   1. Develop sine $(180^\circ - \theta) = \sin\theta$
      a. Discuss sign of function.
   2. Develop cos $(180^\circ - \theta) = -\cos\theta$
      a. Stress sign and direction of measure.
         i. Relate to values on coordinate plane.
   3. Develop tangent $(180^\circ - \theta) = -\tan\theta$
   4. Develop reciprocal functions by number relations and reciprocal law. $(x \cdot \frac{1}{x} = 1)$

D. Classwork:
   1. Example: Find the six functions of 160°.
      Solution: $160^\circ = (180^\circ - 20^\circ)$
      By substituting $(180^\circ - 20^\circ)$ for 160° in the function sin 160° we get $\sin(180^\circ - 20^\circ)$
      Compare $(180^\circ - \theta)$ with $(180^\circ - 20^\circ)$.
      Note: $\theta = 20^\circ$
      Therefore: $\sin(180^\circ - 20^\circ) = \sin 20^\circ$.

   2. Continue finding the remaining functions.
      a. Example: Find the six functions of 110°.

E. Assignment: Find the six functions for the following angles:

   1. 150°
   2. 175°
   3. 91°
   4. 89°
   5. 185°

Lesson 12

I. Trigonometric functions of obtuse angles.

   A. Review formula for trigonometry functions of any obtuse angle.
      1. $\sin(180^\circ - \theta) = \sin\theta$
      2. $\cos(180^\circ - \theta) = -\cos\theta$
      3. $\tan(180^\circ - \theta) = -\tan\theta$
      4. Review reciprocal functions by using law of reciprocals.
         $(a \cdot \frac{1}{a} = +1)$

         thus concluding:
         a. $\csc(180^\circ - \theta) = \csc\theta$
         b. $\sec(180^\circ - \theta) = -\sec\theta$
         c. $\operatorname{ctn}(180^\circ - \theta) = -\operatorname{ctn}\theta$

   B. Review homework.
      1. Call attention to problems 4 and 5 of assignment as not being obtuse angles.

Name_______________________ Date__________

Lesson 12 Classwork

For each exercise;

(a) Draw a diagram to illustrate the situation in the problem.

(b) Label the given single force and the angles which the two component forces make it.

(c) Complete the parallelogram of forces.

(d) Find the component forces which, at the given directions, are equivalent to the one given force.

1. Resolve a force of 50 lbs. into two components, each of which makes an angle of 5 degrees with it.

2. Resolve a force of 50 lbs. into two components, each of which makes an angle of 15 degrees with it.

3. Resolve a force of 50 lbs. into two components, each of which makes an angle of 30 degrees with it.

4. Resolve a force of 50 lbs. into two components, each of which makes an angle of 45 degrees with it.

5. Resolve a force of 50 lbs. into two components, each of which makes an angle of 60 degrees with it.

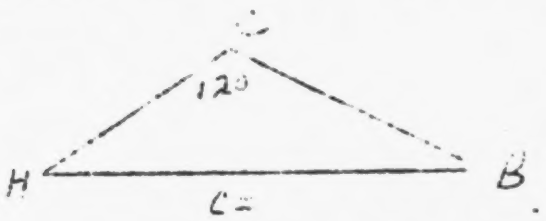
6. Make an estimate: What two components, each of which making an angle of 75 degrees with a 50 lb. force, will be equivalent to that single force?

7. Make an estimate: What two components, each of which making an angle of 85 degrees with a single 50 lb. force will be equivalent to that single force?

Lesson 12 (continued)

C. Solve the following obtuse triangle:

$\angle c = 120°$
$c = 50$ inches
$a = 40$ inches



1. Develop method on board with assistance of class.

D. Classwork: Solve the following triangles (ditto sheet).

E. Assignment: Complete 1 to 5 on ditto sheet.
Announce test in 2 days.

Lesson 13
I. Functions of obtuse angles.

A. Review quiz and homework.

B. Classwork: Word problems 6 - 10 from ditto sheet.

C. Assignment: Announce test; Study and complete ditto sheet. (Give answers to problems on ditto sheet.)

Lesson 14

TEST

Name ______________________________ Date ______________

Lesson 12
Classwork and Assignment

For each exercise:

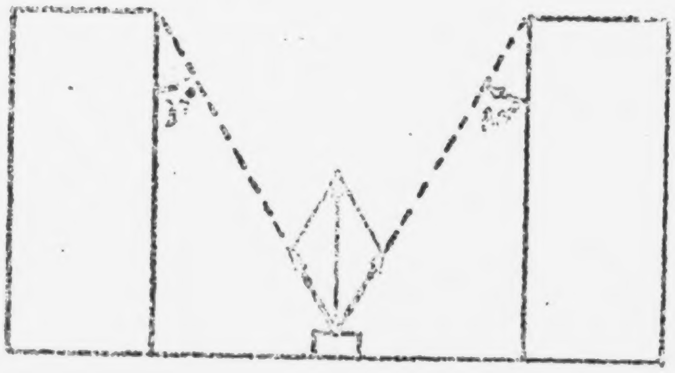
(a) Draw a diagram to illustrate the situation in the problem.

(b) Label all given parts and complete the parallelogram of forces.

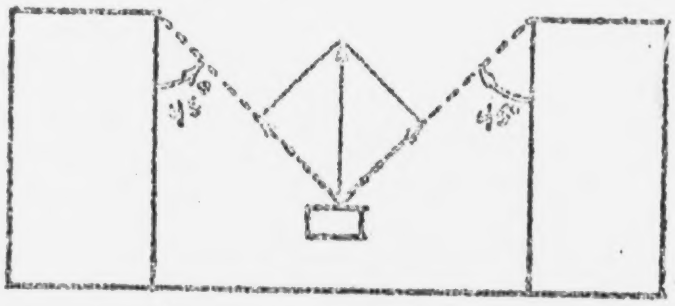
(c) Find the resultant force (one force which will do the equivalent of the two given forces).

(d) Find the angles which the resultant force makes with the two given forces.

1. Two cables are attached at the same height at opposite sides of a street. The two cables support a heavy safe, weighing 1200 lbs. At the instant the safe is lifted from the ground, the cables each form an angle of 30° with the wall of the buildings to which they are attached. Find the pull on each of the cables at that instant.



2. Suppose the two cables in problem 1 have lifted the safe so that now the cables each form an angle of 45° with the walls of the buildings to which they are attached. Find the pull on each of the cables.



3. Suppose the safe in problem 2 is shifted toward the left-hand building so that it can be brought through a window opening. (The left-hand cable is shortened while the right-hand cable is "let-out".) If the angles formed by the cable with the walls are now 30° and 60°, find the pull on each cable now.

4. Suppose the safe is now shifted further toward the left-hand building so that the cable then forms an angle of 25° with the wall of the building while the other cable forms an angle of 65° with the right-hand wall. Find the pull on each cable.

Lesson 12 (continued)

5. Suppose the safe is now shifted still further toward the left-hand building so that the cable then forms an angle of 5° with the wall of the building while the other cable forms an angle of 65° with the right-hand wall.

6. Suppose the safe is now shifted still further toward the left-hand building so that the cable then forms an angle of 1° with the wall of the building while the other cable forms an angle of 59° with the right-hand wall.

Name______________________________ Date________________

Lesson 13 Quiz

1. Write the six functions of an angle whose measure is 115° in terms of angles less than 90°.

2. Solve using the law of cosines:

$\angle C = 65^\circ$
$a = 18''$
$b = 12''$
Find C

II

Name ______________________ Date __________

Lesson 14

Test

For each problem carefully sketch a diagram on graph paper and find the solution using white-lined paper.

1. Find the vector quantity for the vector: A(0,0), B(5,8).

2. Find the vector quantity for the vector C(5,7), D(8,11).

3. Show graphically the single vector to represent this combination of trips:
Two men move a machine 12 feet south and then 8 feet east.

4. An airplane flew west 80 miles and then 120 miles south. What is the straight-line distance from his starting point to his finishing point?

5. Find the distance and bearing from the starting point to the finishing point:

A motor boat starts at a bearing of N 45° W and travels 2500 meters. It then turns and travels 3600 meters on a S 45° W bearing.

6. Resolve a force of 50 lbs. into two components, each of which makes an angle of 45° with it.

7. Resolve the same force and problem (6) into two components, each of which makes an angle of 60° with it.

Introduction to Simple Machines

Lesson 1

I. Understanding "Percent"

- A. Meaning of percent
    - 1. As a common fraction
        - a. Denominator tells number of items in universal set.
        - b. Numerator tells number of items in (a) which are of special interest.
        - c. Practice with universal sets of 100 items.
    - 2. Examples related to quantities containing less than 100 objects.
        - a. Simplicity maintained by using integral factors of 100.
    - 3. Percent as a decimal fraction.
        - a. Stress meaning "Per Hundred"
        - b. Decimals and common fractions.
        - c. Compare common fraction to its equivalent decimal fraction.

- B. Classwork and Assignment: Ditto sheet - Find the percent in both common fraction and decimal fraction form. (Some work problems.)

Lesson 2

I. Comparing common and decimal fractions.

- A. Review definition of percent.
    - 1. Common fraction with denominator 100.
    - 2. Decimal fraction.
        - a. Equivalent forms (1 and 2)
    - 3. A common fraction equivalent to decimal fractions.

- B. Review homework.

- C. Quiz 1. Definition of percent.
    - 2. Word problem similar to homework.

- D. Find percent for universal sets having less than 100 objects.
    - 1. Refer to meaning of percent.
        - a. Change $\frac{2}{5}$ to percent.
            - i. Common fraction in hundredths.
        - b. Set up as a proportion.

$$\frac{2}{5} = \frac{?}{100}$$

Name____ Date_____

Lesson 1
Classwork and Assignment

A. Solve each proportion:

1. $\frac{18}{36} = \frac{x}{100}$
2. $\frac{x}{100} = \frac{3.5}{14}$
3. $\frac{7.5}{30} = \frac{x}{100}$
4. $\frac{8.5}{12} = \frac{x}{100}$
5. $\frac{x}{100} = \frac{16.5}{66}$
6. $\frac{x}{100} = \frac{5.6}{44.8}$
7. $\frac{23}{30} = \frac{x}{100}$
8. $\frac{x}{100} = \frac{29}{35}$
9. $\frac{1.85}{2.42} = \frac{x}{100}$
10. $\frac{x}{100} = \frac{.75}{3.5}$

B. For each exercise set up a proportion to find the percent sought.

$$\frac{\text{number in subset}}{\text{total number}} = \frac{x}{100}$$

1. Last week I had 73 points out of a total of 100 possible on a test. Find the percent I had correct.

2. Jim had 40 points out of 50 on a quiz. Find the percent he had correct.

3. If I had 45 correct out of 50 problems, what percent did I have correct? What percent did I have wrong?

4. If I had 42 correct out of 50, what percent did I have correct? What percent did I have wrong?

5. If I had 50 correct out of 80, what percent did I have correct? What percent did I have wrong?

Lesson 2 (continued)

2. Solve proportions using slide rule.
   a. Refer to Lesson 23 of introduction to algebra.

3. Classwork using slide rule:
   Find percent for the following ratios.

   a. $\frac{1}{5}$
   b. $\frac{21}{42}$
   c. $\frac{3}{4}$
   d. $\frac{6}{7}$
   e. $\frac{2}{9}$
   f. $\frac{25}{50}$
   g. $\frac{26}{50}$
   h. $\frac{29}{50}$
   i. $\frac{55}{72}$
   j. $\frac{131}{262}$
   k. $\frac{135}{540}$
   l. $\frac{120}{600}$
   m. $\frac{25}{83}$
   n. $\frac{35}{83}$
   o. $\frac{5}{70}$

E. Complete problems given for classwork.

Lesson 3

I. Understanding percent.

A. Quiz: (Slide rule - find the percent equivalent to each:

$\frac{3}{8}$, $\frac{4}{9}$, $\frac{24}{65}$, $\frac{17}{32}$.)

B. Review answers for quiz and homework.
   1. Stress meaning of percent as "per hundred".

C. Classwork and assignment: Ditto sheet. Set up to solve word problems using slide rule.

Lesson 4

I. Understanding percent.

A. Quiz (set up and solve one word problem.)

B. Review quiz and homework

Name________________________________ Date________

Lesson 3
Classwork and Assignment

Using a slide rule find the percent sought in each exercise. Use the D scale for the total number possible.

$$\begin{matrix}\text{C scale}\\ \text{D scale}\end{matrix}\quad \frac{\text{Number in Subset}}{\text{Total Number}} = \frac{x}{100}$$

1. I had 6 problems correct out of 12 problems on a test. Find the percent which I had correct.

2. We had a test with 14 problems. I had 8 correct. Find the percent which I had correct.

3. The class has 32 students, 15 of whom are boys. Find the percent of the class which are boys.

4. Find the percent correct on a test if there were 30 problems and I had 18 correct.

5. John earns $120 per week and spends $85 on "room and board". Find the percent of the total which he spends on "room and board".

6. Find the percent corresponding to 35 out of 50.

7. Find the percent corresponding to 8 out of 15.

8. Find the percent corresponding to 65 out of 80.

9. Find the percent corresponding to 75 out of 90.

10. Find the percent corresponding to 95 out of 115.

11. Find the percent corresponding to 8.5 out of 12.5.

12. Find the percent corresponding to 6.5 out of 8.5.

13. Find the percent corresponding to 4.5 out of 21.4.

14. Find the percent corresponding to 3.5 out of 4.

15. Find the percent corresponding to 17.2 out of 32.4.

16. Find the percent corresponding to 1.75 out of 3.56.

17. Find the percent corresponding to 1.65 out of 8.5.

18. Find the percent corresponding to 1.95 out of 9.5.

19. Find the percent corresponding to 4.35 out of 10.5.

20. Find the percent corresponding to 7.95 out of 11.5.

Lesson 4 (continued)

C. 3rd method of reading percent.
   1. Per hundred ⟷ percent
      a. Discuss in French, cent means hundred.
         i. Italian: cento means hundred.

   2. Review:

      a. $\frac{60}{100}$ means 60 per hundred.

      b. "60 per hundred" is also expressed as "60 percent"

      c. "$\frac{60}{100}$" is also expressed as "60 percent".

   3. Symbol for percent is "%".
      a. Thus, "60 percent" can be written as "60%".

      b. $\frac{75}{100}$ can be written as 75%.

   4. Read the following common fractions as equivalent percents:

      a. $\frac{3}{100}$
      b. $\frac{30}{100}$
      c. $\frac{8}{100}$
      d. $\frac{80}{100}$
      e. $\frac{25}{100}$
      f. $\frac{2.5}{100}$
      g. $\frac{.25}{100}$
      h. $\frac{2}{5}$
      i. $\frac{5}{8}$
      j. $\frac{23}{30}$
      k. $\frac{12}{25}$
      l. $\frac{17}{20}$

D. Classwork and Assignment: Solve the following work problems. (Ditto sheet) Complete ditto sheet.

III.

Name______________________________ Date_____

Lesson 4
Classwork and assignment

A. For each exercise solve the proportion using your slide rule:

$$\begin{array}{l} \text{C scale} \\ \text{D scale} \end{array} \quad \frac{\text{Number in Subset}}{\text{Total number}} = \frac{x}{100}$$

1. $\frac{2}{5} = \frac{x}{100}$
2. $\frac{3}{8} = \frac{x}{100}$
3. $\frac{5}{6} = \frac{x}{100}$
4. $\frac{7}{8} = \frac{x}{100}$
5. $\frac{7}{12} = \frac{x}{100}$
6. $\frac{12}{15} = \frac{x}{100}$
7. $\frac{6}{8} = \frac{x}{100}$
8. $\frac{1}{12} = \frac{x}{100}$
9. $\frac{1}{20} = \frac{x}{100}$
10. $\frac{3}{25} = \frac{x}{100}$
11. $\frac{7.5}{18} = \frac{x}{100}$
12. $\frac{1.25}{4.5} = \frac{x}{100}$
13. $\frac{.125}{.750} = \frac{x}{100}$
14. $\frac{.17}{.85} = \frac{x}{100}$
15. $\frac{.02}{.8} = \frac{x}{100}$

B. For each exercise use your slide rule to find the required percent.

1. A screwdriver is made of 2 ounces of steel and one ounce of plastic. What percent of the weight of the screwdriver if plastic? What percent is steel?

2. It is estimated that a person weighing 120 lbs. has 112 lbs. of water in his body. What percent of his weight is water?

3. A toolmaker required 40 hours to make a small punching die. He began by studying the plans for 2 hours. What percent of the time did he spend in this preparation?

4. In a plant which produces lightbulbs, thirty-four bulbs were found defective out of 3500 produced one day. What percent were defective?

5. A man counted the vehicles which passed a busy intersection one day. He counted 14 motorcycles, 85 trucks, and 251 cars. What percent of these vehicles were motorcycles? What percent were trucks? What percent were cars?

Lesson 5

Introduction to Simple Machines

I. Meaning of Efficiency

A. Class discussion
1. Two autos, same model, make and year.

   1st gets 12 miles per gallon of gas
   2nd gets 15 miles per gallon of gas

   (a) Discuss which car has a better efficiency performance.
      (i) Meaning of efficiency
      (ii) Can efficiency be controlled?

2. Ask class to cite other areas where efficiency is important.
   (a) Working in supermarkets and stacking cans on shelves.
      (i) Getting a job done in less time and perhaps less effort.
      (ii) Methods
      (iii) Equipment and machines

3. Briefly discuss electric motors.
   (a) Different types for particular job.
   (b) Elevators of Empire State Building.
      (i) Present size of electric motors
      (ii) Would a ¼ horsepower motor raise the elevator?
      (iii) Discuss efficiency in the time factor comparing an express elevator with its rated motor to the same elevator with a one H.P. motor. Assume different values for the rated motor. (500H.P.), (200H.P.), (100 H.P.)

4. Efficiency: Producing the desired result with a minimum effort.

   (workout/workin) or $\left(\frac{\text{output}}{\text{input}}\right)$

5. Expressing efficiency as a percent.
   (a) Recall: percent means parts per hundred.
   (b) $\frac{\text{work out}}{\text{work in}} = \frac{\text{Efficiency}}{100}$
   (c) A 6 H.P. motor does 5 H.P. units of work. What is the work out? What is the work in? Find the efficiency of the motor.

6. Classwork: Ditto sheet on problems similar to above.

7. Assignment: Complete ditto sheet.

Name________________________________ Date________

Lesson 5

For each exercise use your slide rule to solve the problem.

1. A 6 horsepower motor does 5 horsepower of work. What is the work out? What is the work in? Find the efficiency of the motor.

2. In a plant five men should complete the construction of a truck body in one day under normal conditions. Suppose, one day, six men are required to do a job. What is the work in? What is the work out? What is the efficiency of the group on this day?

3. A 20 horsepower motor does 16 horsepower of work. What is the work out? What is the work in? What is the efficiency of the motor?

4. Linda can type 80 words per minute when her typewriter is in good condition. Today she can type only 65 words per minute. What is her efficiency today as a percent?

5. A 250 horsepower engine does 220 horsepower of work. What is the work out? What is the work in? What is the efficiency of the engine?

6. My car can travel 20 miles per gallon at normal speed. However, at 60 miles per hour she travels only 16 miles per gallon. Find it's gas mileage efficiency at 60 miles per hour.

7. An 85 horsepower motor does 80 horsepower of work. What is the work in? What is the work out? What is the efficiency of the motor?

8. If a car travels 25 miles per gallon at 40 miles per hour but only 20 miles per gallon at 60 miles per hour, what is its efficiency at 60 miles per hour?

9. A tractor can pull a truck weighing 10 tons, under normal conditions. One day this tractor can pull the truck, weighing only 9 tons. What is the efficiency of the tractor this day?

10. Two men can produce 480 pizza pies in a day under normal conditions. Because of difficulty with the oven one day they can produce 440 pies. What is their efficiency that day?

Lesson 6

- I. Review forces.
  - A. Define: tendency to produce or stop motion.
    - 1. Pushing a desk.
    - 2. Lifting a book.
    - 3. Two forces acting against each other. If forces are equal, then no motion.
      - a. Relate to vectors.
      - b. Resultant.

- II. Work
  - A. Definition of:
    - 1. Result of two factors.
      - a. force and distance
    - 2. Work is the product of the force and the distance the force moves.
      - a. Example: A boy wishes to lift a 50 lb. weight 4 feet.
        - (i) A force of 50 lbs. is required to move the weight.
        - (ii) The distance is 4 feet.
        - (iii) Work = 50 lbs x 4 feet.
  - B. Unit of Measure for work.
    - 1. From above example, W = Force x Distance, where Force is in lbs. and Distance is in feet.
      - a. W = lbs. x feet, commonly called foot-pounds.
        - (i) One foot-pound is the English measure for work.
    - 2. Example: A large rock weighs 100 pounds. Find the work done in moving the rock 20 feet.
      - a. Work = force x distance

$$W = F \times S$$

$$W = 100\text{lbs.} \times 20 \text{ feet}$$

$$W = 2000 \text{ foot pounds}$$

(i) Stress unit of measure

  - C. Classwork and Assignment: Ditto Sheet.

Lesson 7

- L. Work
  - A. Review definition of:
    - 1. Product of two factors.
      - a. Force.
      - b. Distance force moves.
        - (i) Note: By definition, force alone is not sufficient to do work.
        - (ii) To push a car with its brakes on does not constitute work. (The car must move).

Name________________________________ Date______

Lesson 6
Classwork and assignment.

Solve each problem. Use your slide rule

1. A man weighs 180 pounds. He climbs a flight of stairs to the second floor, 10 feet above the first floor. How much work did he perform in lifting this weight?

2 How much work is done by a block and tackle in lifting a 1200-lb. machine up 15 feet?

3. How much work is done by a weightlifter who presses 350 lbs. 7 feet?

4. How much work is done in lifting by a young man who carries a 2 pound box of candy up 14 flights of stairs if the distance between consecutive floors in the building is 10 feet?

5. Find the work done by a man using a single pulley and rope to lift a bucket of concrete weighing 45 lbs. to a height of 25 feet.

6. The strong man in the circus can lift 1,000 lbs. to a height of 2". Calculate the work he does.

7. A fork-lift picks up a stack of crates weighing 2500 lbs. to a height of 3". Calculate the work done.

8. The flight elevator on an aircraft carrier can lift a 3-ton airplane to a height of 22 feet. Find the work done by the elevator.

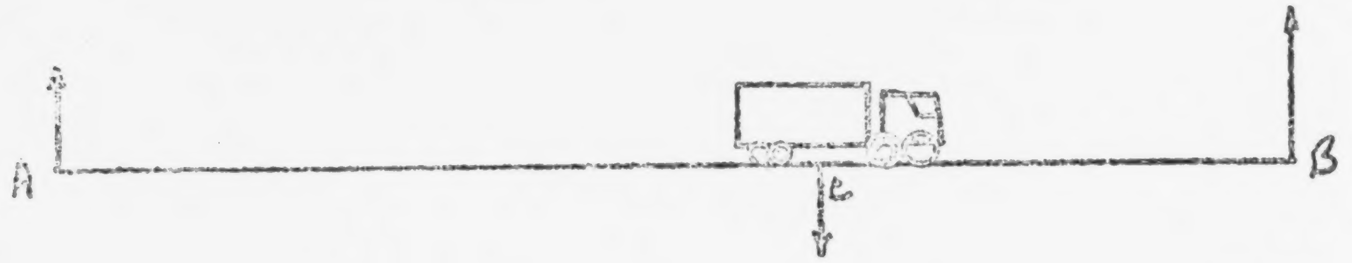
9. A block and tackle lifted a machine weighing 3300 lbs. to a height of 4½ feet. Find the work done.

10. An engine pulled a train weighing 35 tons up a slope to a height of 150 feet higher. Find the work done.

Name________________________________ Date_____

Lesson 7
Assignment

In exercise 1-5 refer to this drawing. The line segment AB represents a bridge which is 80 feet long. The bridge is supported by piers at points A and B. A truck weighing 4,000 pounds is stopped on the bridge with its center of gravity on point C. In your calculations do not consider the weight of the bridge.



1. Suppose point C is 5 feet from point B. Find the upward force which must be exerted by each pier of the bridge to support the weight of the truck.

2. Calculate the upward forces at A and B if the truck is located so that point C is 10 feet from B.

3. Calculate the forces at A and B if the point C is 20 feet from B.

4. Calculate the forces if point C is 30 feet from B.

5. Calculate the forces if C is 40 feet from B.

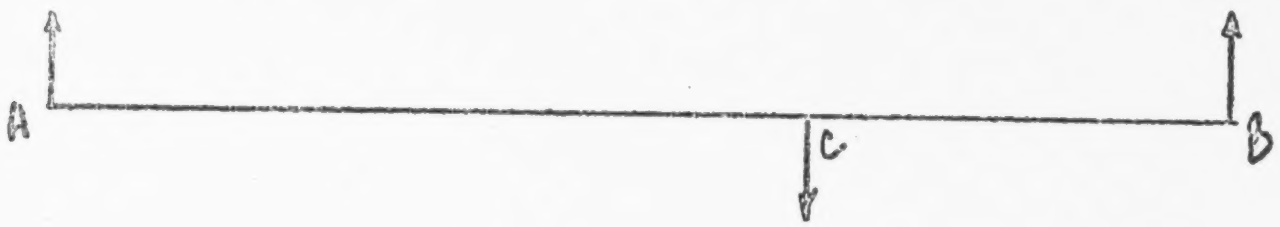
Fill in the following table to show your results of the calculations for exercises 1-5.

Distance AC	Distance BC	Upward Force at A	Upward Force at B
1.			
2.			
3.			
4.			
5.			

Name_______________________________ Date_____

Lesson 7.8
Assignment

In exercises 1-5 refer to the drawing. The line segment AB represents a rigid pole 20 ft. long supported at its end by two boys. A 50 lb. weight is suspended from the pole at the point C. In your calculation do not consider the weight of the pole.



1. Suppose point C is 2 ft. from the boy at point B. Find the upward force which must be exerted by each boy to support the weight.

2. Calculate the upward forces at A and B if the weight is located so that point C is 4 ft. from point B.

3. Calculate the forces at A and B if the point C is 6 ft. from B.

4. Calculate the forces if point C is 8 ft. from B.

5. Calculate the force if C is 10 ft. from B.

Fill in the following table to show your results of the calculations for exercises 1-5.

	Distance AC	Distance BC	Upward Force at A	Upward Force at B
1.				
2.				
3.				
4.				
5.				

Lesson 8

I. Parallel forces and torque.

- A. Review of parallel forces
  - 1. Equilibrium

- B. Review of Torque.
  - 1. The act of producing rotary motion.
  - 2. Direction
    - a. Clockwise
    - b. Counterclockwise
      - (i) perpendicular to radius

- C. Review homework

- D. Classwork and Assignment: Complete ditto sheet.

Lesson 9

I. Machines

- A. Quiz: (1) Definition of torque
  (2) Word problem

- B. Review of equilibrium.
  - 1. Prevention of both:
    - (a) Linear motion and
    - (b) Rotary motion

- C. Review homework

- D. What is a machine?
  - 1. A machine is a device or apparatus which can increase the force applied or increase the speed or distance. It can also be used to change the direction of the force.
    - (a) A machine can be used to help man do heavy work.
    - (b) A machine can be used to relieve man of the burden of work.
    - (c) Can be used to do both.

- E. Example of a Machine
  - 1. Crowbar
    - (a) Discuss simplicity and how force is applied.
    - (b) When a crowbar can be used.
      - (i) Lifting or moving a heavy object.
      - (ii) Forcing objects apart.

2. Work is done when a force acts on some object and moves it.
    a. Work = force x distance ($W = F \times S$)

B. Review homework.

C. Parallel forces.
1. Review: forces acting in same or opposite directions.
    a. Review resultant of parallel forces.
        (i) Algebraic sum and direction.

2. Linear Motion
    a. Moving in one direction.
        (i) Example: Lifting a rock straight up.
        (ii) Example: Two men lifting a chain straight up.
        (iii) Example: Two boys lifting a pole with a weight attached to the pole between the boys.

3. Rotary Motion
    a. Torque:
        (i) Tendency to rotate about a point.
    b. Definition: The effectiveness of a force in producing rotation.

4. Factors involving torque:
    a. Size of force
    b. Force distance from point of rotation
    c. Direction of force in respect to the distance drawn to the point of rotation.

5. Magnitude of torque:
Magnitude of the torque equals the product of the force times the distance from the pivot (radius) where the force is perpendicular to the distance line (radius). ($T = F \times S$)

D. Equilibrium with parallel forces occurs:
1. When the resultant of two or more forces acting in opposite directions is the null vector.
    a. The counterbalancing of forces in opposite directions thus stopping any linear motion.

2. When the forces (clockwise and counterclockwise) react, thus preventing rotary motion.
    a. When the torques both clockwise and counterclockwise torques are equal.

E. Classwork: Ditto sheet (Problems on torque and parallel forces).

F. Assignment: Complete 1 to 5 on ditto sheet.

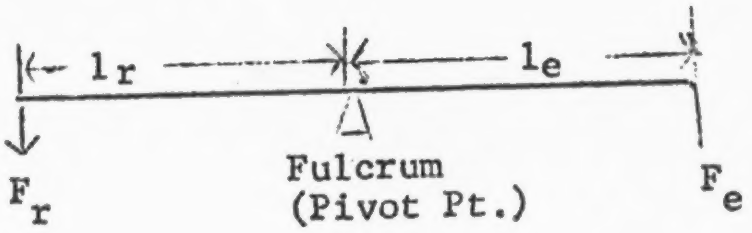
Lesson 9 (continued)

F. The Lever

1. Crowbar is a lever
2. Definition of Lever:
   (a) A bar or like implement which is free to rotate about a fixed point.
3. Parts of a lever
   (a) Fulcrum - Point about which the bar rotates.
   (b) Effort arm - Distance from point of application of the effort force to the fulcrum.
4. Examples of applications of lever.
   (a) See Saw.
   (b) Crowbar.

G. Mechanical advantage of a lever

(1) Diagram



2. Symbols:
   a. F_r is the Resistance Force
   b. F_e is the Effort Force
   c. l_r is the resistance arm
   d. l_e is the effort arm.
3. $F_r \times l_r = F_e \times l_e$
4. $\frac{Fr}{Fe} = \frac{le}{lr}$

H. Classwork: (Ditto Sheet)

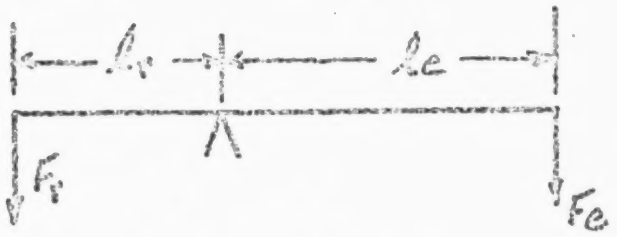
I. Assignment: Study notes and complete first five problems on ditto sheet.

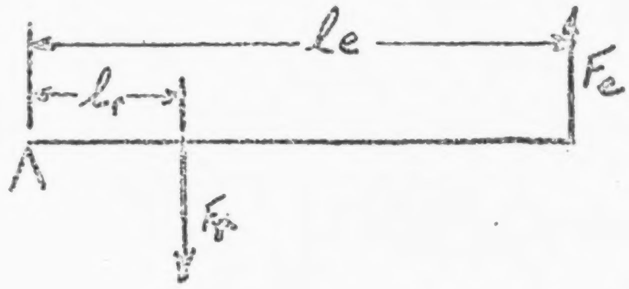
Name______________________________ Date_____

Lesson 9

For exercises 1-5 refer to the drawing of levers. Figure A shows the lever between F_e and F_r. Figure B shows F_r between the fulcrum and F_e. Do not consider the weight of the lever.

l_e is the length of the effort arm.
l_r is the length of the resistance arm.





1. Suppose, in Figure A, that $l_e = 8''$, $F_e = 10$ lbs, and $F_r = 40$ lbs. Calculate the length of the resistance arm l_r.

2. Suppose that l_e, F_r, and F_e have the same values but applied to Figure B. Calculate the length of the resistance arm, l_r.

3. Using Figure A if $l_e = 20''$, $F_e = 8$ lbs., and $Fr = 80$ lbs., find l_r.

4. Using Figure B, if $l_e = 70''$, $F_e = 8$ lbs., and $F_r = 80$ lbs., find l_r.

5. Using figure A, if $l_e = 40''$, $F_e = 25$ lbs., and $F_r = 100$ lbs, find l_r.

6. Using Figure B, is $l_e = 40''$, $F_e = 25$ lbs, and $F_r = 100$ lbs, find l_r.

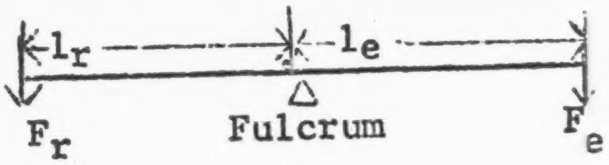
Lesson 10

I. Lever

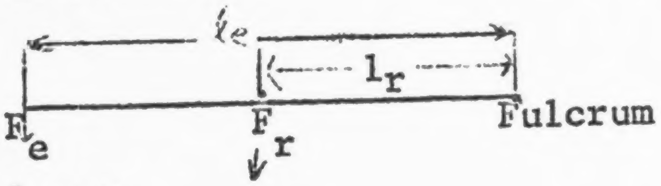
A. Review
1. Definition
2. Parts
3. $F_r \times l_r = F_e \times l_e$

B. Review homework

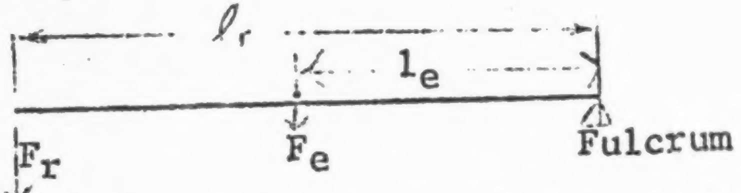
C. Those catagories of the lever.
1. First Class lever
   (a) Fulcrum between effort and the resistance.
   (b) Can be used to increase force.
      (i) l_e is longer than l_r.
      (ii) Example: Tin snips.
      (iii) Crow bar, where l_e is longer than l_r.



2. Second class lever
   (a) F_r is between F_e and fulcrum
   (b) Used only to multiply force ($l_e > l_r$)
      (i) Example:
      (ii) Wheelbarrow



3. Third Class lever
   (a) F_e is between F_r and fulcrum.
   (b) Used only to multiply speed or distance ($l_e < l_r$)
      (i) Example:



D. Classwork: Work on ditto sheet from previous lesson

E. Assignment: Complete ditto sheet.

Lesson 11

I. Lever

A. Quiz: Solve lever problems.

B. Review homework: lever problems.
   1. Principles, classes.
   2. Method of solving problems.

II. Pulley

A. Definition: A pulley is a wheel which is free to turn about an axle which is mounted in a frame.
   1. Examples of pulleys.
      (a) Clothesline.

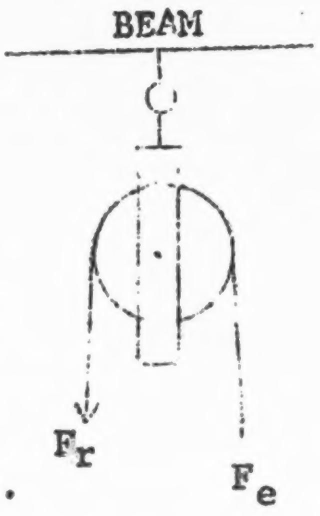
B. Fixed pulley.
   1. Principle: axle is in a fixed position. The wheel rotates but does not move up or down.

   2. Mechanical advantage of a fixed pulley is similar to a lever.

      (a) Fulcrum is the axle

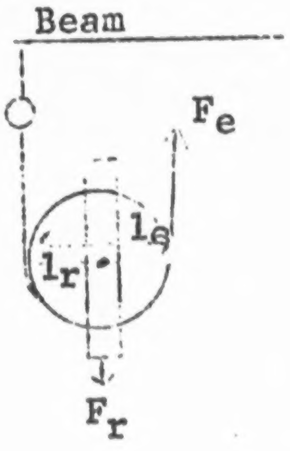
      (b) $l_e = l_r$ = radius of pulley.

      (e) Therefore: M.A. $= \frac{le}{lr} = 1$.



   3. Purpose of fixed pulley.
      (a) Change of direction of force.
         (i) Illustrate with model.

D. Moveable pulley.
   1. Principle: Axle moves with the movement of the load (F_r) while the wheel rotates about the axle.
      (a) Illustrate:



   2. Mechanical advantage of moveable pulley is similar to a lever.
      (a) Fulcrum is the point of contact with the fixed rope.
      (b) l_e = diameter of pulley
      (c) l_r = radius of pulley
      (d) $l_e = 2 x l_r$, therefore, M.A. =2

III. Classwork and assignment: ditto sheet
   A. Complete first five problems on pulleys and levers.

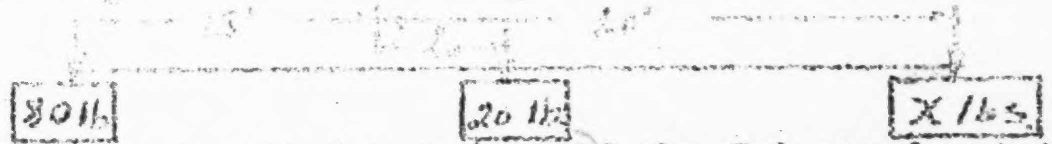
II

Name______________________________ Date______

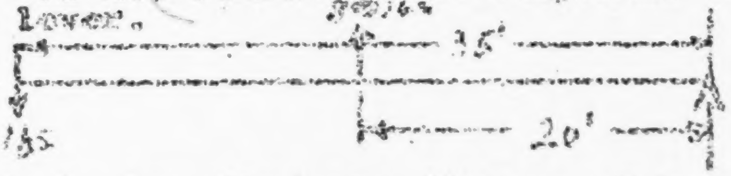
Lesson 11
Classwork and Assignment

Consider the diagram to the right of each problem.

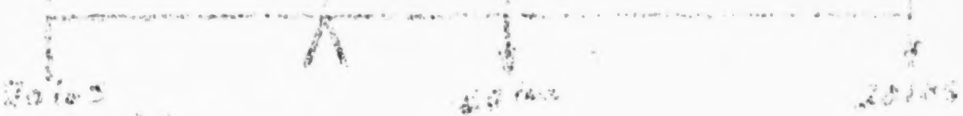
1. Find F_e if the lever weighs 20 lbs. Find A.M.A. of the lever.



2. Find F_e to push lever down if the fulcrum is at the extreme right end of the lever. Do not consider the weight of the lever. Find AMA of the lever.

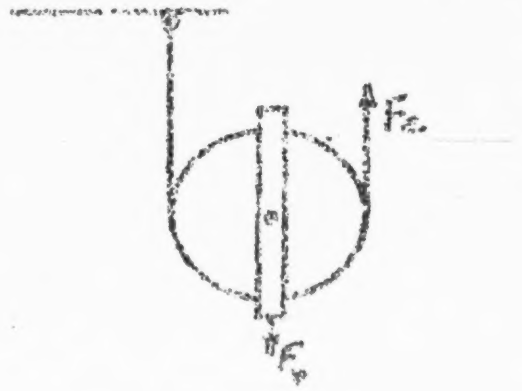


3. Neglecting the weight of the bar find the distance X beyond the location of the 40 lb. weight, where a 20 lb. weight must be placed to balance the 80 lb. weight. Find the AMA of the lever.



4. Find the IMA of a movable pulley with a diameter of 18.

5. Find the IMA of a fixed pulley with a diameter of 18.



6. Sketch a block and tackel which has an IMA of 5/1.

7. A man wishes to lift a machine weighing 1200 lbs. with a block and tackle but he weighs only 150 lbs. What IMA should he require of the block and tackle? Sketch a block and tackle which would have this IMA.

Lesson 11 (continued)

8. A man can exert a downward force of 180 lbs. uses a block and tackle having an IMA of 4/2. What is the heaviest weight which he can lift?

9. What block and tackle would a man who can exert a downward force of need to lift a weight of 800 lbs? Sketch the block and tackle.

10. What is the largest IMA possible to develop using fixed separate pulleys? Sketch the pulley system to illustrate your answer.

Lesson 12

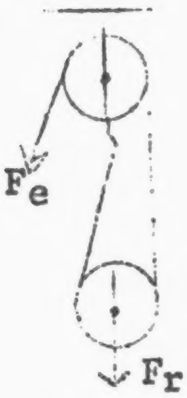
I. Pulleys
   A. Review fixed pulley.
      1. Rotation only.
      2. M.A. = 1.

   B. Moveable pulley.
      1. Rotation and axle movement.
      2. M.A. = 2

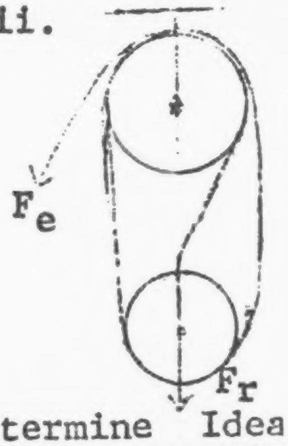
   C. Review homework
      1. Discuss M.A. in each problem.

   D. Pulley Combinations
      1. Block and tackle.
         a. Two sets of wheels (or more).
            (i) one set fixed
            (ii) one set moveable.
         b. Examples

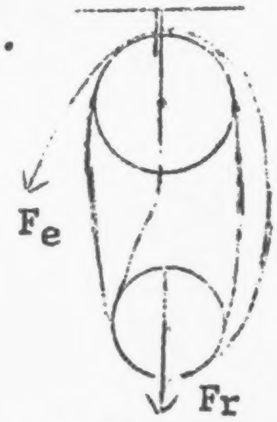
i.



ii.



iii.



         c. Determine Ideal Mechanical Advantage (IMA) of each example in b (above).
            (i) I.M.A. = 2
            (ii) I.M.A. = 3
            (iii) I.M.A. = 4

   E. Classwork: Determine I.M.A. of each pulley system and complete each pDoblem. (Ditto Sheet) (6 to 10)

   F. Assignment: Complete ditto sheet.

Lesson 13

I. Pulleys and Levers

   A. Quiz
   B. Review of:
      1. Fixed single pulley.
      2. Moveable single pulley.
      3. Pulley Combinations.
         (i) I.M.A.
   C. Review homework; review lever

   D. Classwork: Ditto sheet on lever problems and pulley problems.
   E. Assignment: Complete: ditto sheet.

III

Name_______________________________ Date______

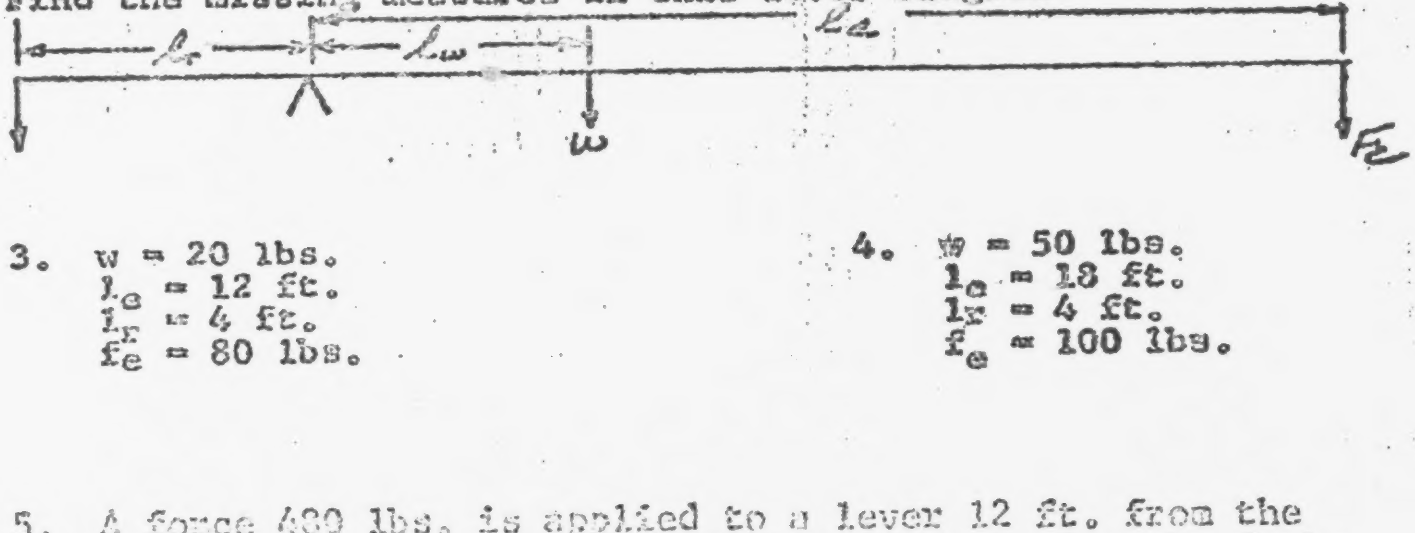
Lesson 13
Classwork and Assignment

1. A force of 50 lbs. is exerted on the rope of a block and tackle and the rope is pulled 30 feet. This work causes a weight 200 lbs. to be raised 5 feet. What is the IMA of the machine? What is the AMA of the machine?

   What is the efficiency of the machine?

2. A force of 120 lbs. is exerted on the rope of a block and tackle and the rope is pulled 50 feet. This work causes a weight of 840 lbs. to be raised 5 ft. What is the IMA of the machine? What is the AMA of the machine? What is the efficiency of the machine?

Find the missing measures in this lever diagram



3. w = 20 lbs.
   l_e = 12 ft.
   l_r = 4 ft.
   f_e = 80 lbs.

4. w = 50 lbs.
   l_e = 18 ft.
   l_r = 4 ft.
   f_e = 100 lbs.

5. A force 480 lbs. is applied to a lever 12 ft. from the fulcrum. The lever weighs 20 lbs. If the length of the resistance arm is 6 ft., find the weight of the heaviest object which the 80 lb. force can lift.

6. A 20-foot lever has its fulcrum at one end. The lever weighs 30 lbs. If a 100 lb. force is applied, what would the length of the resistance arm have to be to lift a 150 lb. weight?

7. A 15 foot lever has its fulcrum at one end; the lever weighs 24 lbs. If a 90 lb. force is applied, what would the length of the resistance arm have to be to lift a 255 lb. weight?

Lesson 14

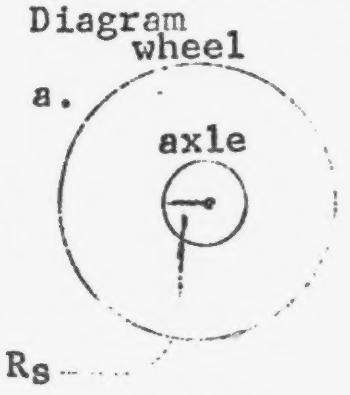
I. Pulleys and Levers

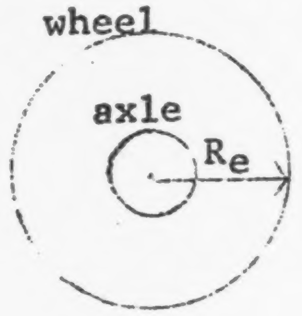
A. Review homework
1. Stress I.M.A. of machines and M.A. of machines.

II. Wheels and Axle

A. Description.
1. A wheel secured to an axle or a smaller wheel.
   a. Discuss axle as a smaller wheel.
2. Related to a lever with unequal arms, where the arms are the circumference of the wheels.
3. Diagram

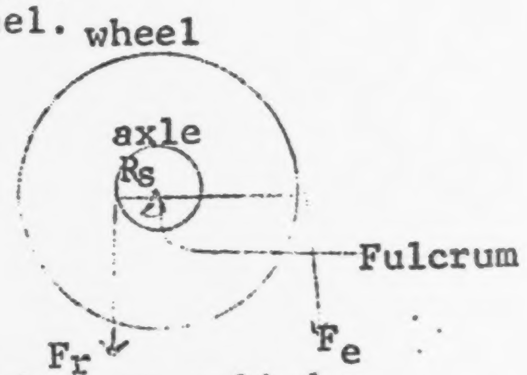
a.





b. Rs is radius of axle.
c. Re is radius of wheel.

B. Operation of wheel and Axle



a. Discuss wheel as a drum or cylinder where Fe is attached to rope or cable wound about the cylinder.
b. Likewise Fr about the axle.

2. Movements of F_r and F_e.

a. When wheel makes one complete revolution, the axle also makes one complete revolution.
   (i) Therefore Fe will move down the distance of the circumference of wheel (2 π Rs)

3. I.M.A. (Ideal Mechanical Advantage) of wheel and axle.
   a. Compare the circumference of wheel to the circumference of axle.

(i) I.M.A. = $\frac{2\pi Re}{2\pi Rs}$ or = $\frac{\text{circumference of wheel}}{\text{circumference of axle}}$

(ii) Where $\frac{2\pi Re}{2\pi Rs} = \frac{2\pi}{2\pi} \times \frac{R_e}{R_S} \quad \frac{R_e}{R_s}$

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Lesson 14
Classwork and Assignment

1. A windlass is a type of wheel and axle. Suppose a windlass having a wheel with radius 3 feet and axle with radius 1' is to lift a weight of 120 lbs. What is the IMA? What is the AMA of the machine?

2. A wheel and axle is set up so that the diameter of the wheel is 2' and the diameter of the axle is 6". What is the IMA?

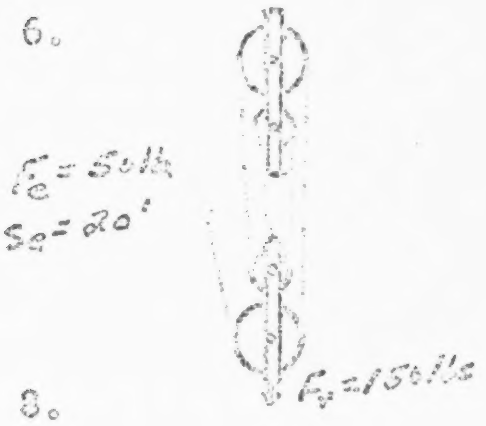
3. A wheel and axle is made so that when the rope attached to the wheel is pulled 8 feet, the rope attached to the axle moves 2 feet. What is the IMA? If the diameter of the axle is .75", what is the diameter of the wheel?

4. A wheel and axle is set up so that when the rope attached to the wheel is pulled 6 feet the rope attached to the axle moves 1½ feet. What is the I.M.A.? If the diameter of the wheel is 2.4 ft., what is the diameter of the axle?

5. A wheel and axle is made so that when the rope attached to the wheel moves 12 feet, the rope attached to the axle moves 1½ feet. What is the IMA of the machine? If the diameter of the axle is 8", what is the diameter of the wheel?

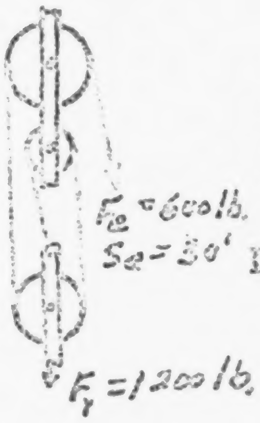
For exercises 6-10, refer to the diagram to find the data requested:

6.



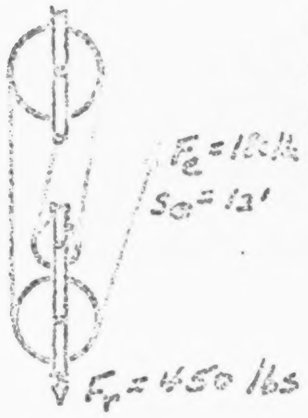
S_R =
IMA =
AMA =
Win =
W_{out} =
EFF =

7.



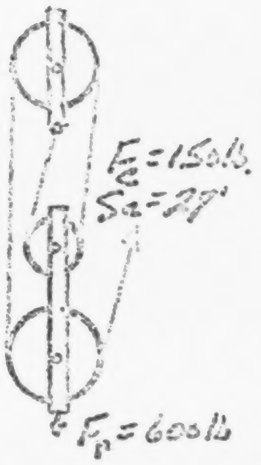
S_R =
IMA =
AMA =
W_{in} =
W_{out} =
EFF =

8.



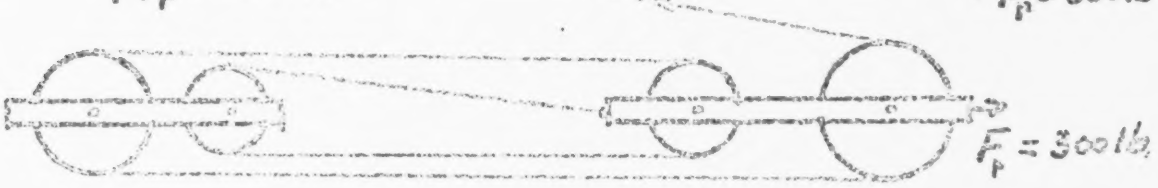
S_R =
IMA =
AMA =
W_{in} =
W_{out} =
EFF =

9.



S_R =
IMA =
AMA =
W_{in} =
W_{out} =
EFF =

10.



S_R =
IMA =
AMA =
W_{in} =
W_{out} =
EFF =

4. Applications of Wheel and Axle.
    a. Winch on tow truck to lift.
    b. Pulley on a motor shaft.
        (i) May be step-up or step-down pulley.

5. Classwork: ditto sheet.

6. Assignment: Complete first 5 problems on ditto sheet.

Lesson 15

I. Wheel and Axle

A. Quiz

B. Review Principles of wheel and axle.
    1. Review homework

C. Classwork: Ditto sheet 6 to 10.

D. Assignment: Complete ditto sheet

Lesson 16

I. Wheel and Axle

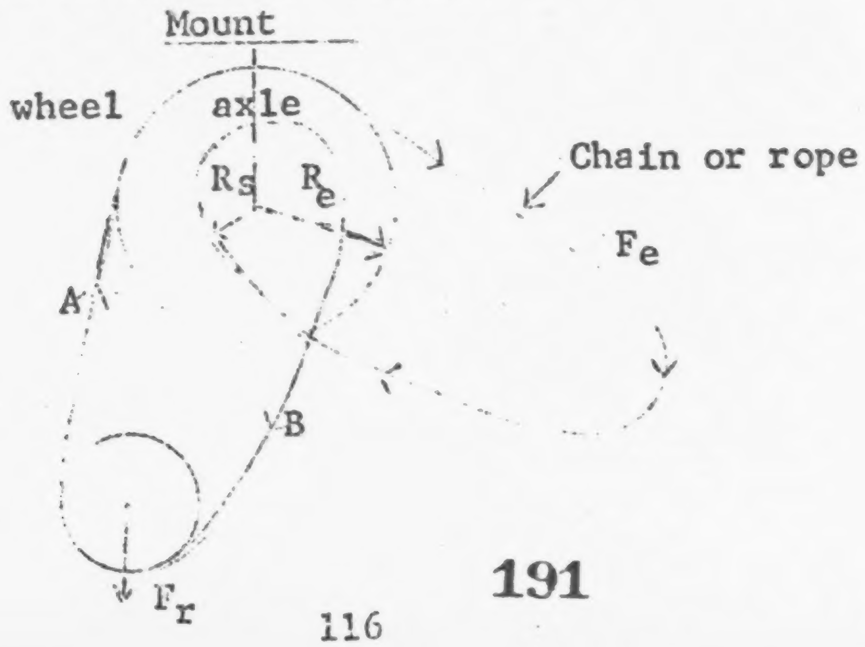
A. Snappy review of principles.
    1. S_e and S_r.
    2. $\text{IMA} = \frac{Re}{Rs}$

    3. Review homework

II. Different Pulley

A. Compound Machine
    1. Wheel and Axle
    2. Pulley

B. Diagram of Parts and Motion.



Lesson 16 (continued)

1. F_e moves distance equal to circumference of wheel ($2\pi R_e$) in one revolution.

2. Rope section A is moved a distance equal to circumference of wheel. ($2\pi R_e$)

3. Rope section B is moved a distance equal to circumference of axle. ($2\pi R_s$)

4. From above we observe that the distance between the center of the axle and the center of the pulley is shortened, thus raising F_r.
   a. Reverse direction of F_e and F_r will be lowered. or distance between centers will be greater.

5. Change of distance between centers for one revolution.
   a. Rope supporting pulley is shortened, ($2\pi R_e$ - $2\pi R_s$)
      i. The distance ($2\pi R_e$ - $2\pi R_s$) is divided between rope A and rope B.
      ii. Thus, distance between centers is shortened $\frac{1}{2}$ ($2\pi R_e$ - $2\pi R_s$).

6. I.M.A. $\frac{2\pi R_e}{\frac{1}{2}(2\pi R_e - 2\pi R_s)}$ or $\frac{R_e}{R_e - R_s}$

   a. Relate I.M.A. to $\frac{\text{Effort distance}}{\text{Resistance distance}}$

7. Example: Chain block used to raise large overhead doors.

B. Classwork: Ditto sheet on Differential Pulley.

C. Assignment: Complete 1-5 on ditto sheet.

Lesson 17

I. Differential Pulley

A. Quiz:

B. Review Differential Pulley
   1. Detail review of previous lesson.
      a. Direction of rope (motion).
      b. Reaction on distance between centers.

C. Review homework.

D. Classwork and Assignment: Complete ditto sheet.

Name________________________________ Date_____

Lesson 16
Classwork and Assignment

1. A differential pulley has a wheel and axle. The radius of the wheel is 18", the radius of the axle is 12". For each revolution of the wheel of the wheel, how far is the pulley (and resistance force) raised? Find the IMA for the machine.

2. A differential pulley has a wheel diameter of 18" and an axle diameter of 12". For each revolution of the wheel, how far is the resistance force raised? Find the IMA of the machine.

3. A differential pulley has a wheel diameter of 24" and an axle diameter of 18". For each revolution of the wheel, how far is the resistance force raised? Find the IMA of the machine.

4. A differential pulley has a wheel diameter of 20" and an axle diameter of 15". For each revolution of the wheel, how far is the resistance force raised? Find the IMA of the machine.

5. A differential pulley has a wheel diameter of 24" and an axle diameter of 8". For each revolution of the wheel, how far is the F_r raised? Find the IMA of the machine.

6. A differential pulley has a wheel radius of 20" and an axle radius of 15". For each revolution of the wheel, how far is the F_r raised?

7. A differential pulley has a wheel radius of 12" and an axle radius of 6". For each revolution of the wheel, how far is the F_r raised?

8. A differential pulley has a wheel diameter of 18" and an axle diameter of 6". For each revolution of the wheel, how far is the F_r raised?

9. A differential pulley has a wheel diameter of 22" and an axle diameter of 12". For each revolution of the wheel, how far is the F_r raised?

10. A differential pulley has a wheel diameter of 20" and an axle diameter of 14". For each revolution of the wheel, how far is the F_r raised?

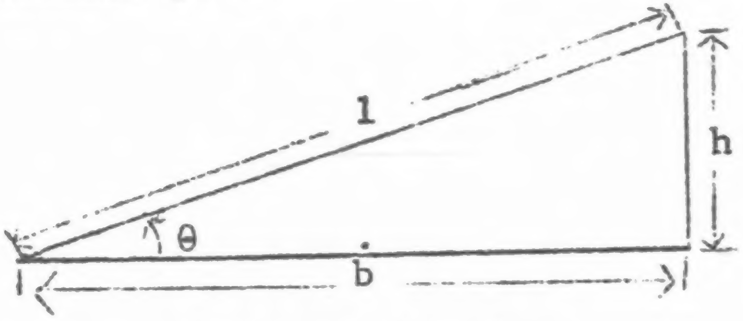
Lesson 18

I. Differential pulley

- A. Quiz (one word problem)
- B. Snappy review
  - 1. Parts of
  - 2. Principle of
- C. Review homework

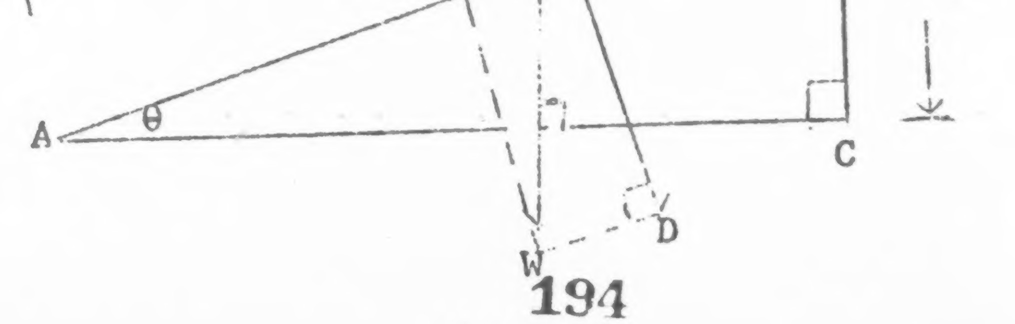
II. Inclined Plane

- A. Definition of: A flat surface with an angle of elevation between 0^o and 90^o.
  - 1. Develop in reference to coordinate axes:
    - a. Let x-axes represent a horizontal plane.
    - b. Let y-axes represent a vertical plane.
    - c. Show an inclined plane in first quadrant.
      - (i) Refer to unit in algebra.
    - d. Review slope of an inclined plane.
- B. Parts of an inclined plane
  - 1. Diagram



- a. "l" is the length of the plane.
- b. "h" is the height of the plane.
- c. "b" is the base of the plane.
- d. "θ" is the angle of inclination.

- C. Application: To raise or lower objects from one level to another.
- D. Forces on an inclined plane.
  - 1. Diagram



Lesson 18 (continued)

a. OW represents the weight force of the load (gravitational pull).
b. OD represents the weight force of the load on the inclined plane ($\perp$ to AB).
c. OF represents the weight force of the load that tends to slide down the slope.
   (i) Note: OF is equal in magnitude to DW

   (ii) OF and FO = 0 vector (null vector), equal to OF is sufficient to stop movement of load.
d. Angle θ, or the angle of inclination, can be found by use of sine function.

   (i) $\text{Sine } \theta = \frac{h}{l}$
e. $F = W \times \frac{h}{l}$

   (i) $F \times l = W \times h$

   (ii) $\frac{W}{F} = \frac{l}{h}$
f. $\text{I.M.A.} = \frac{l}{h}$

g. $\text{A.M.A.} = \frac{W}{F}$ or $\frac{F_r}{F_e}$

C. Review efficiency

1. $\text{Eff.} = \frac{\text{Work out}}{\text{Work in}}$

   a. Work out = $F_r \times S_r$

      (i) Fr is resistance force (weight)
      (ii) Sr is the distance weight is moved (vertically).
   b. Work in = $F_e \times S_e$

      (i) Fe is the effort force required to move the weight.
      (ii) Se is the distance the weight moves along the inclined plane.

2. $\text{Eff} = \frac{Fr \times Sr}{F_e \times S_e}$ (by substitution)

3. $\text{Eff} = \frac{AMA}{IMA} \times 100\%$

D. Classwork (example) A load of lumber is rolled (pushed) up an inclined plane 10 feet long to a platform 2 ft. above the ground.

1. Find IMA
2. Find Fe if AMA=IMA (assuming no fraction)
3. Find AMA if the actual Fe is 100 lbs.
4. Find Work out put
5. Find Work in put
6. Find efficiency if Fe is 100 lbs.

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Lesson 18
Classwork and Assignment.

For each exercise:
- a. Draw diagram to illustrate the problem.
- b. List information on your drawing.
- c. Always write formulas used.

I.M.A. = $\frac{\ell}{h}$, A.M.A. = $\frac{F_r}{F_e}$, Work out = F_r x h,
Work in = F_e x ℓ, Efficiency = $\frac{\text{Work out}}{\text{Work in}}$

1. A 200 pound load of lumber is pushed up an inclined plane 10 feet longer to a platform 2 feet above the ground. How much effort is required if friction is neglected?

2. A man can exert a force of 150 lbs. and must load a 450 lb. weight into a truck 4 feet high. How long a plane will be needed if we do not consider friction?

3. An inclined plane 10 ft. long is needed to raise an 800 lb. weight onto a platform with an effort of 200 lb. Neglecting friction, how high must the platform be?

4. An 800 lb. weight is to be pushed up a plank 12 feet long onto a truck 4 feet above the ground. How much effort is required if friction is neglected?

5. A truck body weighing 1200 lbs. is loaded onto a platform 5 feet high by means of planks 20 feet long. Neglecting friction, how much force must be exerted parallel to the planks in order to move the truck body?

6. A man can exert 150 lbs. of force. He must load a 600 lb. weight onto a platform 5 feet above the ground. How long a plank will he need if we do not consider friction?

7. An inclined plane 20 feet long is needed to raise a 900 lb. weight onto a platform with an effort 150 lbs. Neglecting friction, how high is the platform?

8. A crate weighing 600 lbs. is pushed up an inclined plane 15 feet long to a platform 3 feet high. How much effort is required if friction is neglected?

9. A man can exert a force of 120 lbs. and must load an 800 lb. crate into a truck 3 feet high. How long a plank will he need if friction is neglected?

10. A crate weighing 1200 lbs. is to be pushed up a plank 16 feet long onto a truck 4 feet above the ground. How much effort is required if friction is neglected?

Lesson 18 (continued)

E. Classwork and Assignment: (ditto sheet) inclined planes.

1. Draw diagrams of problems
2. List information
3. Always write formula

Lesson 19

I. Inclined plane

A. Quiz (Give formulas of following IMA, AMA, Work out, Work in, Eff)

B. Review parts of Inclined plane
   1. Refer to right triangle
      a. Formulas
         (i) IMA
         (ii) AMA
         (iii) Work Out
         (iv) Work in
         (v) Eff

C. Review homework
   1. Discuss what happens as "θ", the angle of inclination, is increased.

D. Classwork: Complete ditto sheet and Assignment

Announce test in 2 days.

Lesson 20

I. Inclined plane

A. Quiz (work problem on inclined plane).

B. Review of principles and parts of the inclined plane.

C. Review Lever
   1. Classwork on lever problem.

D. Review Pulley
   1. Classwork on pulley problem.

E. Review Wheel and Axle
   1. Classwork on problem involving wheel and axle.

F. If time, question on work and test.

G. Assignment: Review for test.

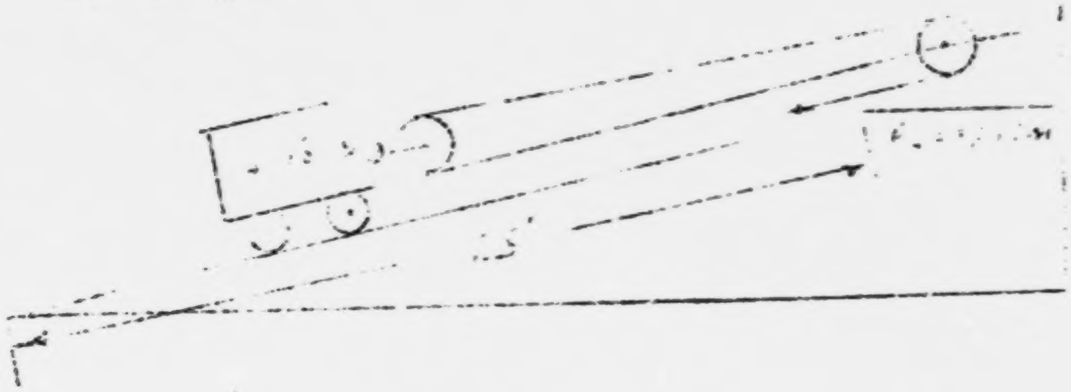
Lesson 21 Test on Ditto Sheets

Lesson 22

I. Review test

II. Compound Machines

A. Inclined Plane and Pulley
  1. Diagram



  2. Find M.A. of Inclined plane
  3. Find F_e of inclined plane assuming no friction
  4. F_e of inclined plane is the actual F_r of the Pulley.
    a. Find M.A. of pulley
    b. Find the F_e the man at the pulley exerts to move the F_r of the pulley.
      (i) But F_e of inclined plane is equal to F_r of pulley.
      (ii) Thus F_e at the pulley is the force required to move the 4 tons up the inclined plane.
  5. Multiply the M.A. of inclined plane by M.A. pf pulley.
  6. Divide the F_e applied on the pulley into the 4 ton weight.
    a. Compare 5 and 6 of above.
  7. M.A. of the compound Machine is equal to the product of the M.A. of the individual machines.

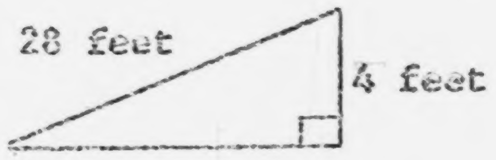
B. Classwork: Ditto Sheet on compound machines.

C. Assignment: Complete ditto sheet.

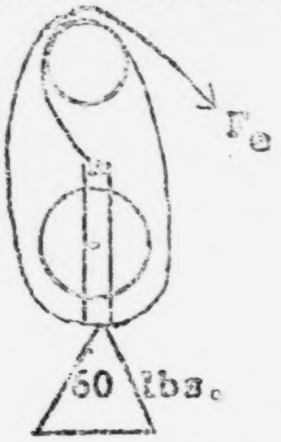
Date

Lesson 21
Test

1. Find the Ideal Mechanical Advantage (IMA) of the inclined plane.

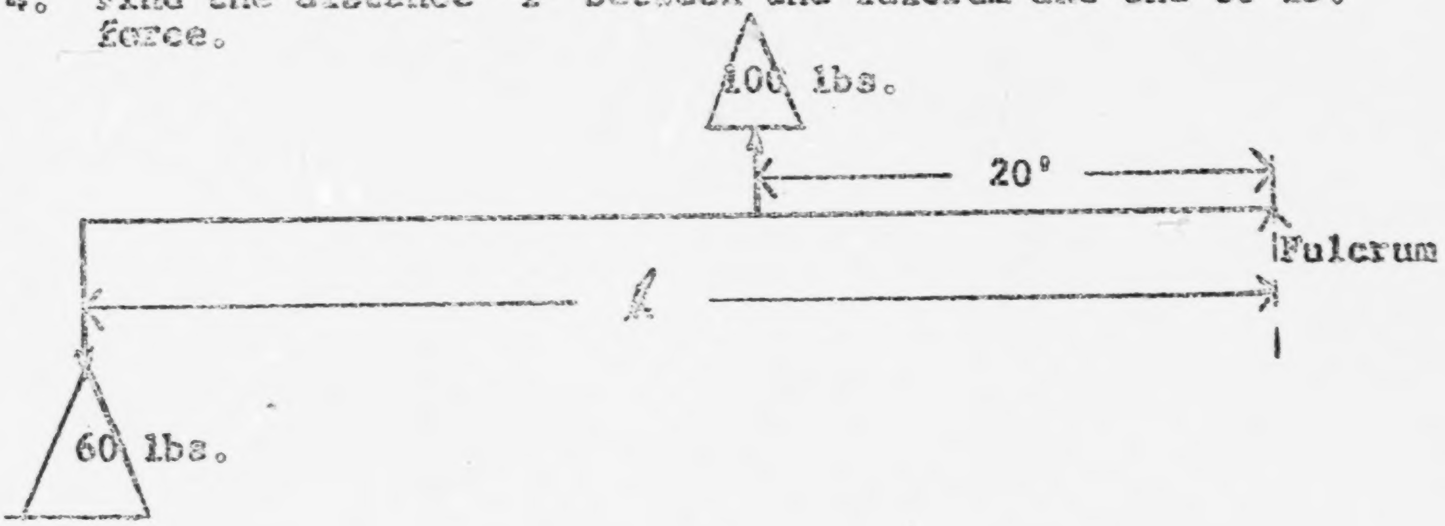


2. Find IMA of the Block and Tackle:

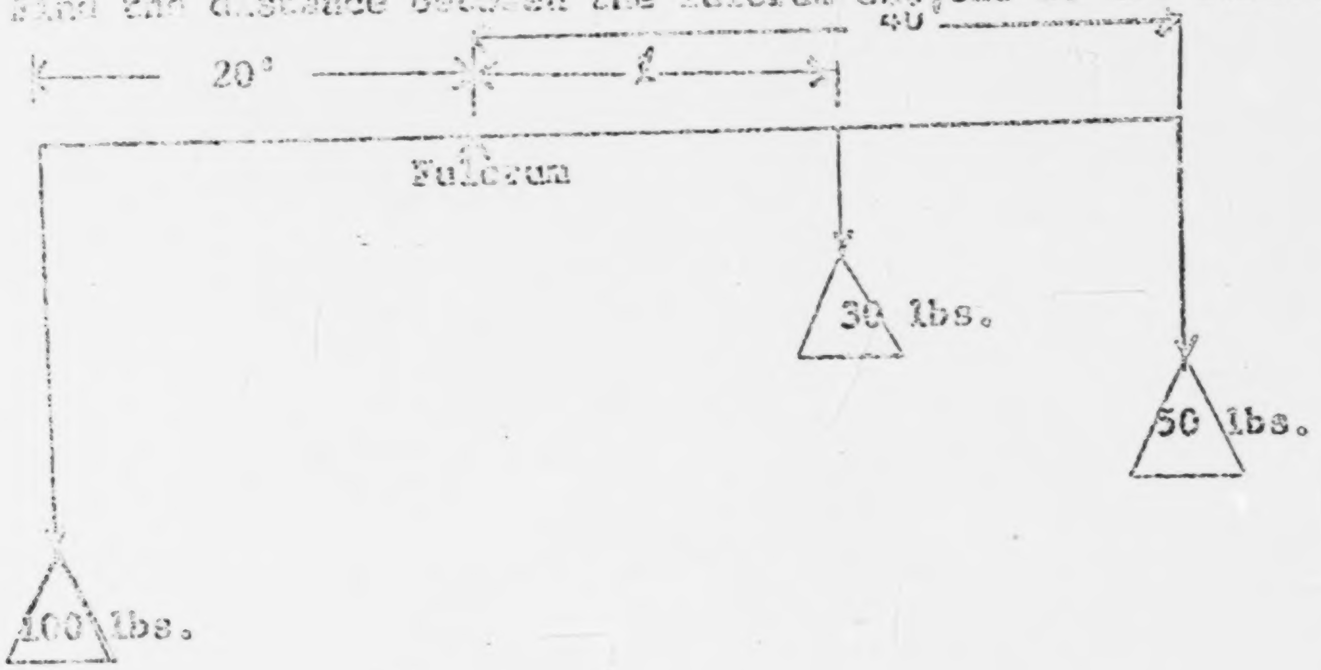


3. Find F_e of problem No. 2.

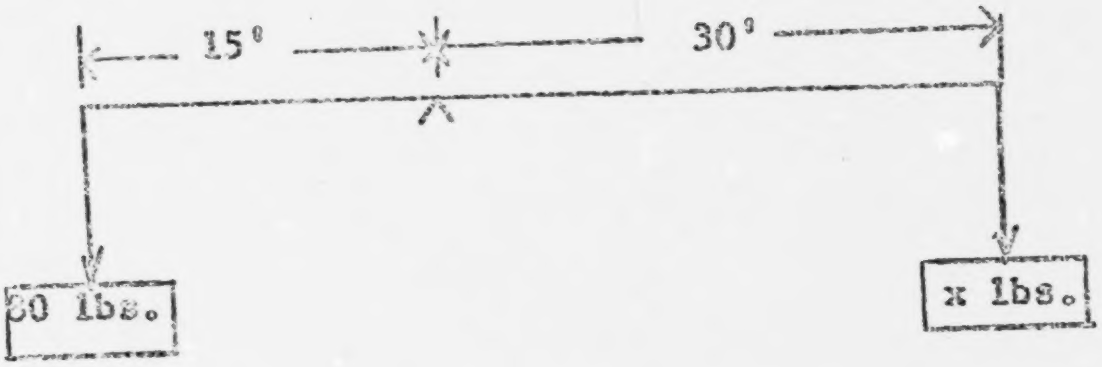
4. Find the distance "l" between the fulcrum and the 60 lb. force.



5. Find the distance between the fulcrum and the 20 lb. force.



6. Find the missing force:



7. A block and tackle has a mechanical advantage of 5 and a man exerts a force of 80 pounds. How many pounds can the block and tackle move?

8. A man pushes a block of ice weighing 250 lbs. up an inclined plane 25 feet long. The angle of inclination is 30°. How much work has the man accomplished upon completion of the job?

9. A load of steel weighing 4 tons is to be pulled up an inclined plane 25 feet long and 5 feet high. Find the IMA and the AMA of the plane if it requires 1,400 pounds to push the load.

10. Find the efficiency of the machine in problem 9.

Name________________________________ Date_____

Lesson 22
Classwork and Assignment:
- a. Make a drawing to illustrate the problem.
- b. Label the given parts.
- c. Write all formulas used.

1. A 2000 lb. weight is to be pulled to a height of 5 ft. up a ramp 25 ft. long by two men using a block and tackle having five supporting strands. Find the IMA of this compound machine. Find the effort force, neglecting friction and the weight of the block and tackle to move the weight up the ramp.

2. Two men can exert a force of 300 lb. If they use a block and tackle having 4 supporting strands to move the weight up a 25-foot long ramp to a height of 5 ft. what is the largest weight they could move? Neglect friction and the weight of the block and tackle.

3. A man can exert a force of 120 lbs. If he uses a block and tackle having 6 supporting strands to move a weight up a 15 foot ramp to a height of 3 feet, what is the largest weight he could move? Neglect friction and the weight of the block and tackle.

4. A 3000 lb. crate is to be pulled up a 20 foot long ramp by two men using a block and tackle having five supporting strands parallel to the surface of the ramp. The ramp is 4 ft. high. Find the IMA of this compound machine. Find the effort force neglecting friction and the weight of the block and tackle, to move the weight up a ramp.

5. Two men can exert a force of 350 lbs. If they use a block and tackle having five supporting strands to move a weight up a 25 foot ramp to a height of 6 feet, what is the largest weight they could move? Neglect friction and the weight of the block and tackle.

Lesson 23

I. Compound Machines.

A. Quiz.

B. Review M.A. of Compound Machines.
  1. Break compound machines into individual machines.
    a. Show how load (resistance F_r) decreases for each machine.
    b. Total M.A. = product of individual M.A. of each machine.

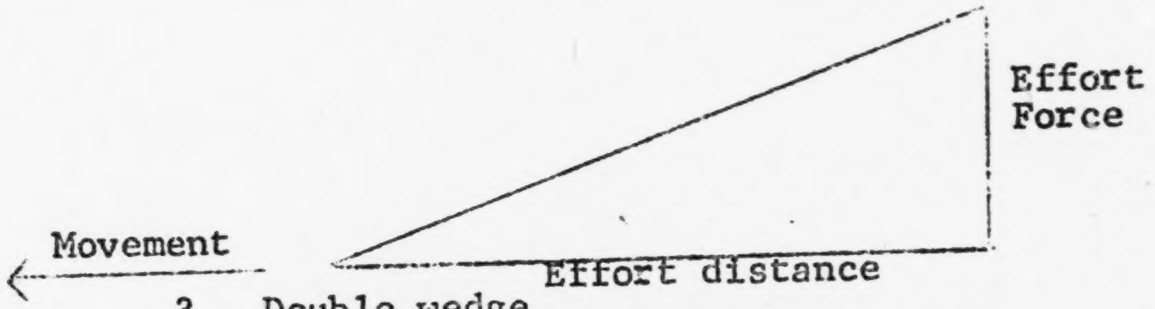
C. Review assignment

II. The Wedge

A. Relate to inclined plane.
  1. Inclined plane-fixed.
  2. Wedge-moveable.

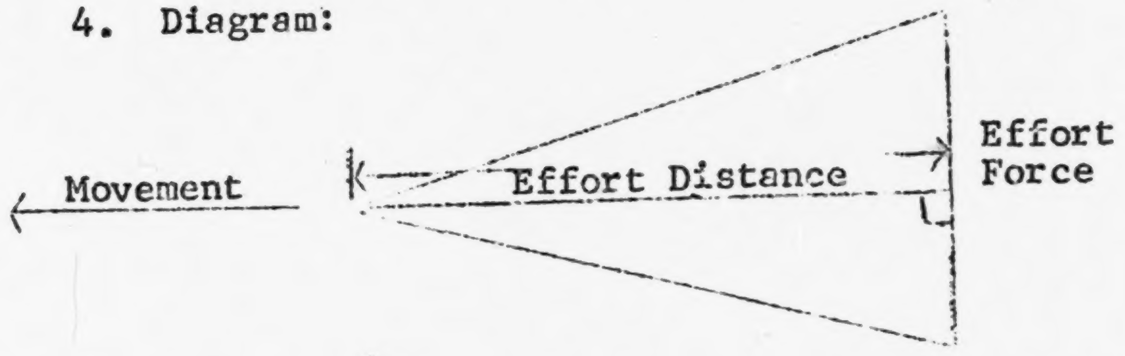
B. Single or double wedge.
  1. Single wedge.
    a. Used to hold door open.
      (i) shape of a right triangle.

  2. Diagram of Wedge.



  3. Double wedge
    a. Used to split logs
      (i) Two right triangles base to base.

  4. Diagram:



  5. I.M.A. = $\frac{b}{h}$

C. Assigmment: Ditto Sheet on Machines.

Name________________________ Date_____

Lesson 23

Quiz

1. An inclined plane is 30 ft. long. The angle of inclination is 30°. Find the height of the plane.

2. An inclined plane 50 ft. long has a height of 5 ft. A winch with a M.A. of 12 is pulling the weight up the inclined plane. Find the total M.A. of the inclined plane and the winch. Find the F_e required at the winch.

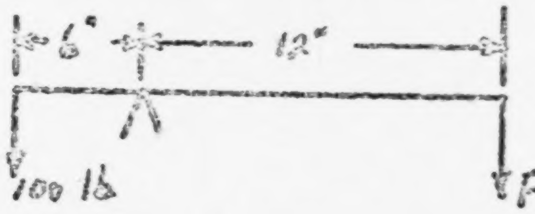
Classwork and Assignment
Lesson 23

For each exercise draw a diagram, state the formula used, and solve the problem.

1. A 300 lb. barrel is rolled up a 12-foot-long plank into a truck 4-feet high. How much effort is required if friction is neglected?

Complete the missing value for each lever problem. Neglect the weight of the lever.

2.



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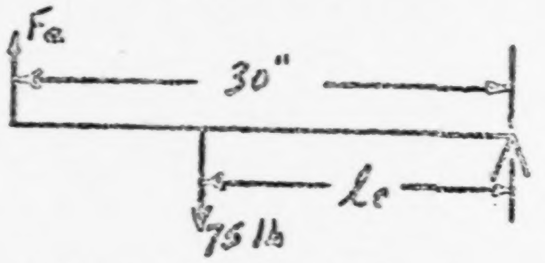
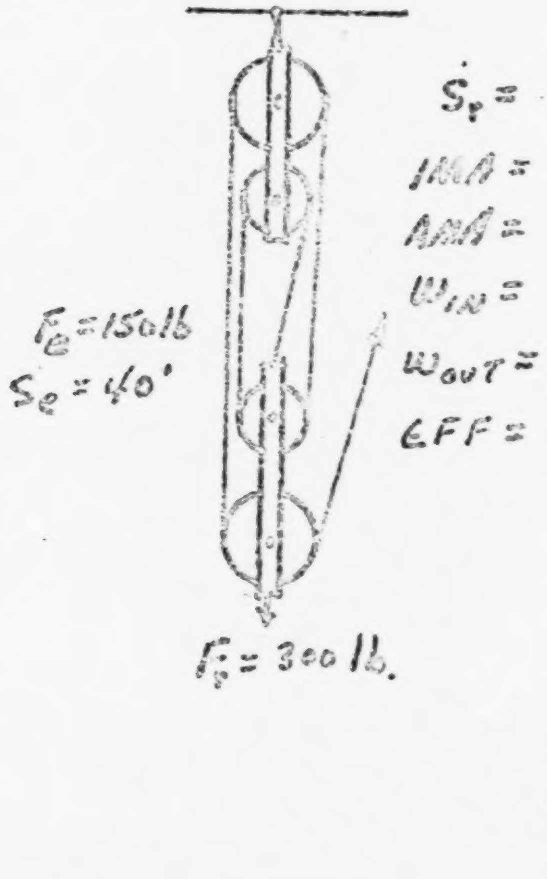
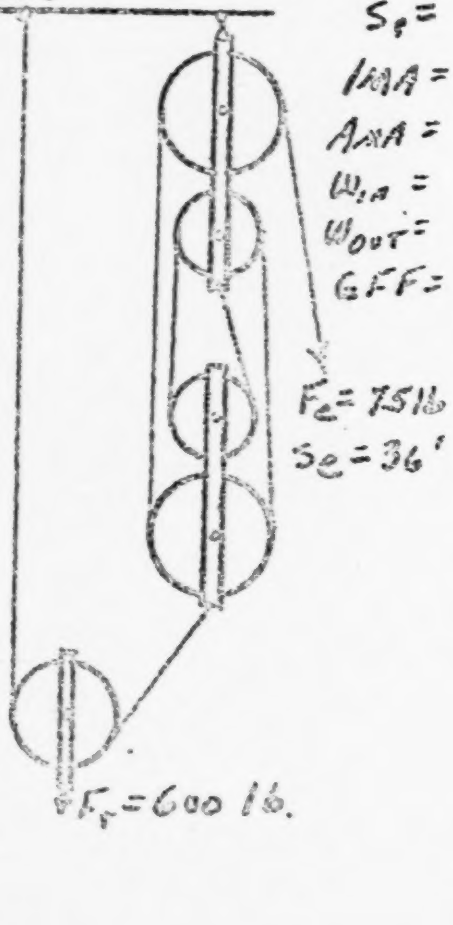


Complete the missing value for these problems on blocks and tackle. Neglect the weight of the equipment.

4.



5.



6. A differential pulley has a wheel and axle. The radius of the wheel is 15" and the radius of the axle is 9". For each revolution of the wheel, how far is the pulley raised? Find the I.M.A. of the machine.

7. A man can exert a force of 140 lbs. If he uses a block and tackle having 6 supporting stands to move a weight up a 12-foot ramp to a height of 4 feet, what is the largest weight he can move? Neglect friction and the weight of the block and tackle.

8. Two men can exert a force of 300 lbs. If they use a block and tackle having five supporting stands to move a weight up a 24-foot ramp to a height of 4 ft. what is the largest weight they could move? Neglect friction and the weight of the block and tackle.

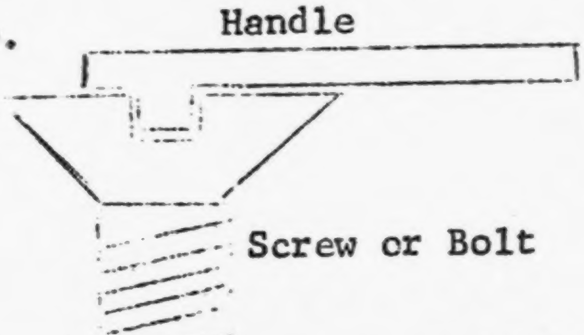
Lesson 24

I. Wedge

- A. Review principles of wedge.
  - 1. Example of use.
- B. Review homework.

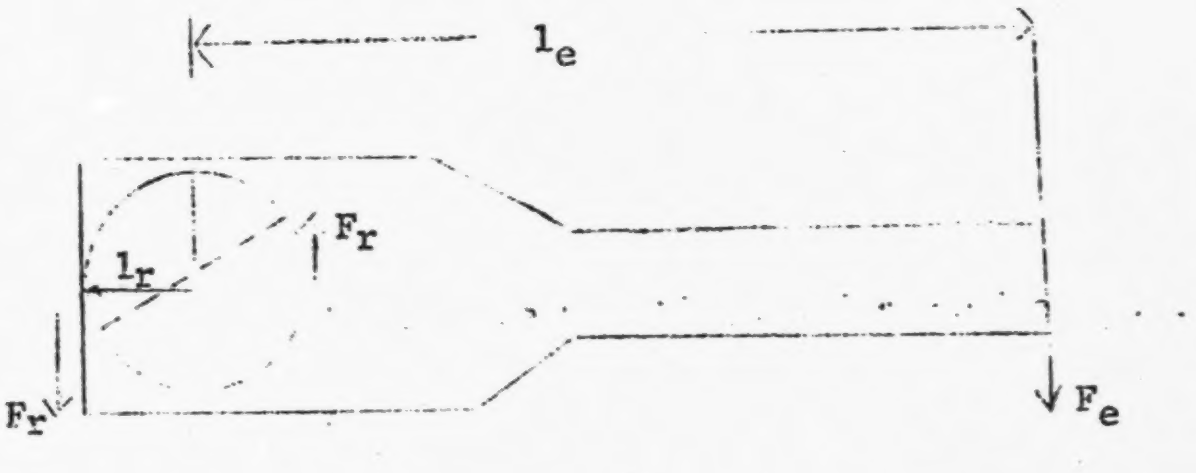
II. Screw.

- A. Principle: An inclined plane wound about a cylinder or cone.
  - 1. Pitch: Distance between threads.
    - a. Example: Suppose a screw has 4 threads per inch. The pitch is $\frac{1}{4}$ or .25.
    - b. Example: Suppose a screw has 8 threads per inch. The pitch is $\frac{1}{8}$ or .125.
  - 2. M.A. of a screw.
    - a. Diagram:



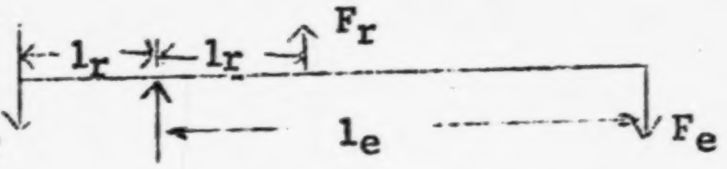
- (i) To turn the screw one complete turn the handle must make a complete revolution.
- (ii) Length of handle will determine F_e to drive the screw.

  - 3. Analygy of handle and screw.
    - a. Diagram

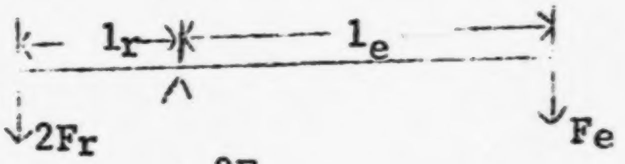


(i) Relate to first and second class lever.

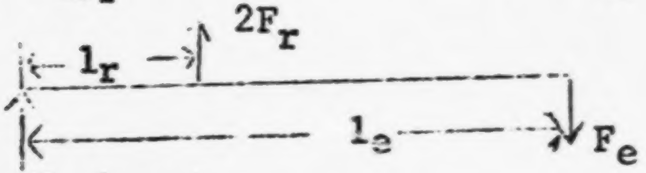
a.



b.



c.



b. Work in = Work out.

(i) Work in = $F_r \times S_r$

(L) F_r = Resistance force

(B) S_r = Pitch

(ii) Work out = $F_e \times S_e$

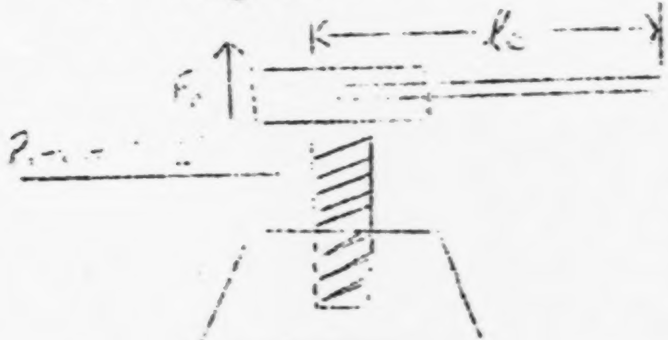
(L) F_e = Effort force

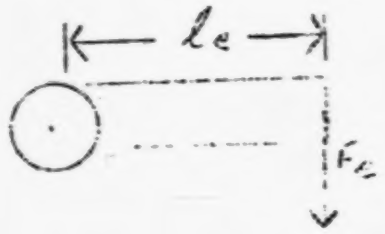
(B) S_e = Distance Fe moves (2π r) or (2π l_e) from diagram 3 (a).

c. $\text{I.M.A.} = \frac{S_e}{S_r} = \frac{2\pi\, l_e}{\text{pitch}}$

3. Example: A jackscrew has a pitch of .2 inches and the handle is 15 inches long. Find the I.M.A.

a. Diagram





b. $S_e = 2\pi$ 1 or $2\pi \times 15$ inch

c. S_r = pitch or .2 inch

d. $\text{I.M.A.} = \frac{S_e}{S_r} \text{--} \quad \frac{2\pi \;\; 15 \text{ inches}}{.2 \text{ inches}}$

$\text{I.M.A.} = 300\pi.$

Name______________________ Date____

Lesson 24

For each exercise sketch the figure indicated, write the formula used, and solve the problem.

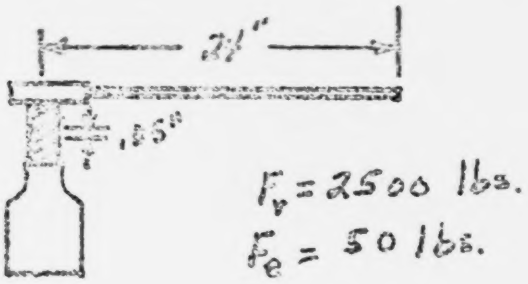
1. A jackscrew has a pitch of .3 inches and the handle is 16 inches long. Find the S_e, S_r, and I.M.A. of the jackscrew.

2. A jackscrew has a pitch of .2 inches and the handle is 20 inches long. Find the S_e, S_r, and I.M.A. of the jackscrew.

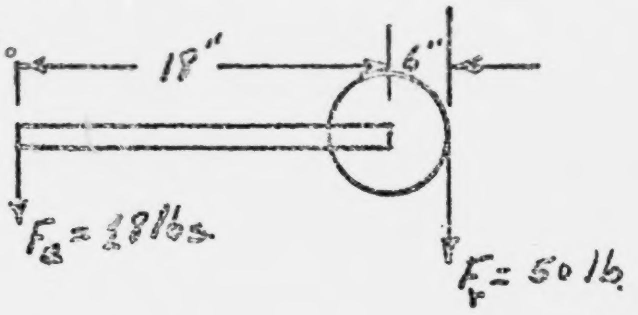
3. A jackscrew has a pitch of .3 inches and the handle is 25 inches long. Find the S_e, S_r, and I.M.A. of the jackscrew.

In each diagram determine the requested quantities

4.



5.

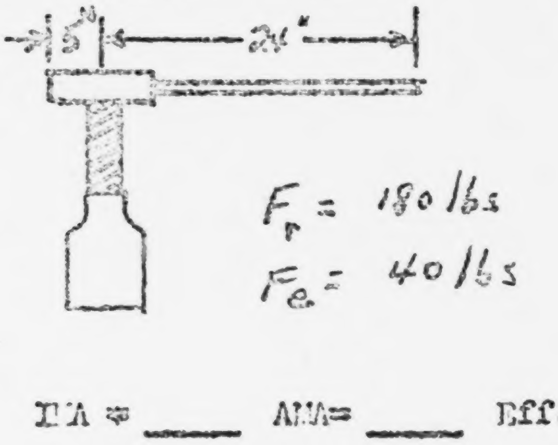


IMA = ____ W_{in}= ____ Eff = ____

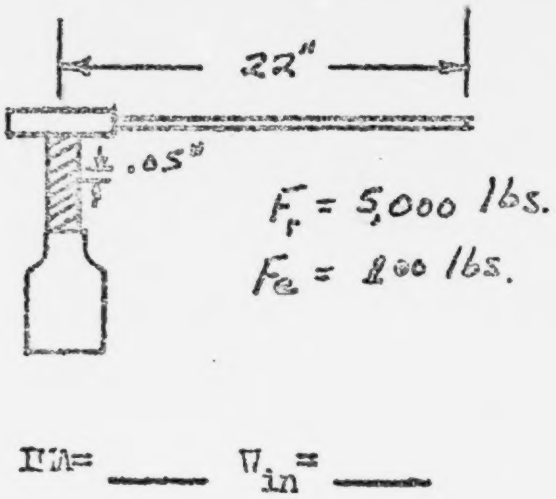
AMA = ____ W_{out}= ____

IMA = ____ AMA = ____ EFF= ____

6.



7.



IMA = ____ AMA= ____ Eff.= ____

IMA= ____ W_{in}= ____

AMA= ____ W_{out}= ____

Eff = ____

8. What mechanical advantage is obtained by using a wrench with a 6 in. handle to tighten bolts having 16 threads to the inch?

9. What is the mechanical advantage of a small jackscrew which has 10 threads to the inch if the lever arm is 5 in. long? What weight may be raised if a force of 25 lbs. is exerted at the end of the lever arm?

10. A jackscrew has a lever arm 2 ft. long. The screw has 3.5 threads to the inch. If 50 lbs. of force must be exerted in order to raise a load of 6 tons, calculate the efficiency.

11. A jackscrew has a lever arm 15 inches long. The screw has 5 threads to the inch. If 50 lbs. of force must be exerted in order to raise a load of 6 tons, find the efficiency.

12. A jackscrew has a lever arm 18 inches long. The screw has 4 threads to the inch. Find the force required to raise 6 tons if the efficiency is 60%.

13. The lever of a screw is 21 inches long. If the screw has 4 threads to the inch, find the I.M.A. If the machine were 100% efficient, what force would be needed to raise 40,000 lbs. Since the machine is 75% efficient, find the actual force required to raise the 40,000 lbs. What factors contribute to the loss of efficiency?

14. Show how the wedge and the screw are actually applications of the inclined plane.

Lesson 24 (continued)

B. Classwork and Assignment: Ditto Sheet

Lesson 25

I. Screw

A. Quiz
1. What determines the S_r of a jackscrew?
2. Define S_e of a jackscrew.
3. How do you find the I.M.A. of a jackscrew?

B. Review principles of jackscrew
1. Pitch-determined by the number of threads per inch.
    (i) Resistance distance S_r determined by pitch or distance between 2 threads.
2. Lever arm "1" determines S_e or effort distance (2π 1)
3. $\text{I.M.A} = \frac{S_e}{S_r}$

C. Review homework
1. Analyze each problem carefully on blackboard.

D. Classwork and Assignment: complete Ditto Sheet. Announce coming test on simple machines.

Lesson 26

I. Jackscrew

A. Quiz
1. One problem on Jackscrew

B. Snappy review of principles of machines.

1. S_r, F_e, S_e, I.M.A.

C. Review homework

D. Classwork and Review of all simple machines covered to date.

E. Assignment: 1st. 5 problems on ditto sheet and study for test.

Lesson 27

I. Review simple Machines.

A. Review Assignment in class.
1. Have students go over each type of problem at board.
    a. Stress concepts and formulas.

B. Assignment: Continue ditto sheet and prepare for test.

Name________________________________ Date_____

Lesson 26
Assignment: review problems

1. What mechanical advantage is obtained by using a wrench with a 6 in. handle to tighten bolts having 16 threads to the inch?

2. What is the mechanical advantage of a small jackscrew which has 10 threads to the inch if the lever arm is 5 in. long? What weight may be raised if a force of 25 lb. is exerted at the end of the lever arm?

3. A jackscrew has a lever arm 2 ft. long. The screw has 3.5 threads to the inch. If 30 lb. of force must be exerted in order to raise a load of 6 tons, calculate the efficiency.

4. A block and tackle is used to pull a large block of granite up an inclined plane. If the mechanical advantage of the plane is 10 and the mechanical advantage of the block and tackle is 4, what is the mechanical advantage of the combination?

5. A safe weighing 4000 lb. is to be pulled up an inclined plane 20 ft. long onto a platform 4 ft. high. A block and tackle having a mechanical advantage of 5 is attached to the safe. If it requires two men, each pulling with a force of 125 lbs., to move the safe, what is the efficiency?

6. A jackscrew has a lever arm 15 inches long. The screw has five threads to the inch. If 50 pounds of force must be exerted in order to raise a load of 6 tons, find the efficiency.

7. A jackscrew has a lever arm 18 inches long. The screw has four threads to the inch. Find the force required to raise 6 tons if the efficiency is 60%.

8. The lever of a screw is 21 inches long. If the screw has four threads to the inch, find the IMA of this machine. If the machine is 75% efficient, find the A.M.A. If the machine were 100% efficient, what force would be needed to raise 40,000 lbs.? Since the machine is 75% efficient, find the actual force required to raise the 40,000 lbs. What factors contribute to the loss of efficiency?

9. Show how the wedge and the screw are actually applications of the inclined plane.

Lesson 28

I. Review for test tomorrow.

  A. Complete ditto sheet
    1. Summerize for test.

  B. Assignment: Study for test

Lesson 29

TEST "on Ditto Sheet"

Lesson 30

I. Review Test

II. Gears

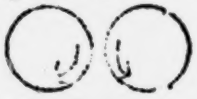
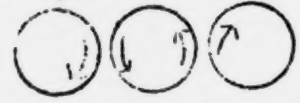
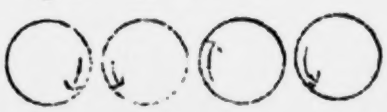
  A. Basically cylinders or cones with protrusions

  B. Types
    1. Spur gear.
      a. Cylinder with teeth parallel to shaft.
      b. Used to drive shafts in parallel.

    2. Bevel gears.
      a. Cones with teeth.
      b. Used to divide shafts that are oblique.

    3. Helical gears.
      a. Similar to spur gear,
      b. Teeth not parallel with shaft.
      c. Angle of operation determined by angle of teeth.

    4. Worm gear.
      a. Similar to a large screw.
        (i) Acme or square type thread.

  C. Rotation of gears (direction).
    1. Examples:
      a. Two spur gears:
        (i)  opposite directions
      b. Three spur gears:
        (i) 
      c. Four spur gears:
        (i) 

Name________________________ Date____

Lesson 29

1. What mechanical advantage is obtained by using a wrench with a 8 in. handle to tighten bolts having 24 threads to the inch?

2. A jackscrew has a lever arm 18 inches long. The screw has 4 threads to the inch. If 60 lb. of force must be exerted in order to raise a load of 12,000 lbs. Find the efficiency.

3. A load of steel weighing 4 tons is to be pulled up an inclined plane 30 feet long onto a platform 5 feet high. A block and tackle having a mechanical advantage of 5 is used to pull the load of steel to the platform. If it requires a force of 350 lbs. to move the load, find the:

   1. I. M. A. of the inclined plane.
   2. I. M. A. of the block and tackle.
   3. I. M. A. of the compound machine.
   4. A. M. A. of the compound machine.
   5. Efficiency of the compound machine.

Lesson 30 (continued)

2. Conclusion on directions of rotation of gears:
    a. Driver goes in opposite direction to the driven gear.
        (i) General:
            (L) Even numbers of gears: driver or first gear goes in opposite direction to the last driven gear
            (B) Odd number of gears: driver or first gear goes in same direction as last driven gear.

D. Controlling speed of gears.
    a. Controlled by number of teeth on each gear.
        (i) If driver gear has fewer teeth than driven gear, then, the driven gear makes fewer revolutions than the driver gear.
    b. Speed ratio of a gear set.
        (i) The speed of the driven gear is directly dependent upon the ratio of the number of teeth of the driver gear to the number of teeth of the driven gear.

(ii) $\text{V.R.} = \frac{V1}{V2} = \frac{t1}{t2}$

where V.R. = speed ratio

V1 = speed of driver gear

V2 = speed of driven gear

t1 = number of teeth in driver gear

t2 = number of teeth in driven gear

E. Example: Find the speed ratio of a nine tooth gear driving a thirty-six tooth gear.

F. Example: Find the speed ratio of three gears if the driver gear has 9 teeth, and 2nd gear or intermediate gear has 18 teeth, and the driven gear has 36 teeth .

1. Total $\text{V.R.} = \frac{t1}{t2} \times \frac{T2}{T3} \times \frac{T3}{T4}$ x etc.

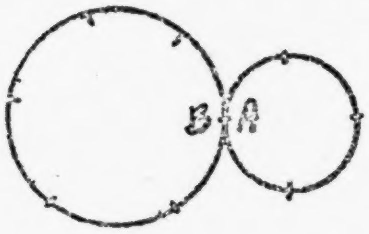
G. Classwork and Assignment: Ditto Sheet on Gear trains

Name____ Date_____

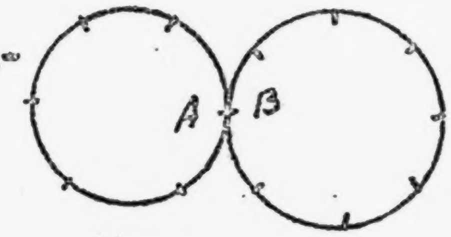
Lesson 30
Classwork and assignment.

1. A nine-tooth gear drives an eighteen-tooth gear. As the driver gear rotates six times, how many times does the driven gear rotate?

2. A four-tooth gear drives a six tooth gear. In the diagram points A and B on the two gears, touch. How many revolutions must each gear make until the points A and B will again touch?



3. A six-tooth gear drives an eight-tooth gear. In the diagram, points A and B, on the two gears, touch. How many revolutions must each gear make until the points again touch?



4. A three-tooth gear drives a 5-tooth gear. If two teeth, one on each gear, are touching, how many revolutions must each gear make until the teeth again touch?

5. An eight-tooth gear drives a 14-tooth gear. If two teeth, on each gear, are touching, how many revolutions must each gear make until the teeth again touch.

6. Find the speed ratio of an eight-tooth gear driving a thirty-two tooth gear.

7. Find the speed ratio of a twelve-tooth gear driving a 56-tooth gear.

8. Find the speed ratio of an eighteen-tooth gear driving a 72-tooth gear.

9. Find the speed ratio of three gears if the driver gear has 9 teeth, the second gear has 18 teeth, and the driven gear has 36 teeth.

10. Find the speed ratio of three gears if the driver gear has 12 teeth, the second gear has 9 teeth, and the driven gear has 6 teeth.

11. Find the speed ratio of three gears if the driver gear has 12 teeth, the second gear has 20 teeth, and the driven gear has 32 teeth.

12. Find the speed ratio of four gears if the driver gear has 18 teeth, the second gear has 12 teeth, the third gear has 20 teeth, and the driven gear has 36 teeth.

Lesson 31

I. Gears

- A. Review types.
  - 1. Spur, Bevel, Helical, Worm.

- B. Review gear trains.
  - 1. Driver, Driven, and Intermediate gears.
  - 2. Directions of gears.
    - a. Even number of gears.
      - (i) Driven and driver (first and last) go in opposite directions.
    - b. Odd number of gears.
      - (i) Driver and driven go in same direction.

  - 3. Control of gear speed.
    - a. Dependent on number of teeth in each gear.
      - (i) If driver has less teeth than driven, than driver rotates faster than driven.
      - (ii) If driver has more teeth than driven, than driver rotates slower than driven.

- C. Review homework

- D. If time, begin general review for midterm exam.
  - a. Three Ditto Sheets on various problems.

- E. Assignment: Ditto Sheet No.1 (review) 1 to 5.

Lesson 32

I. General review for midterm examination

- A. Work on ditto sheet
  - 1. Refer to notes for aids in problem solving.

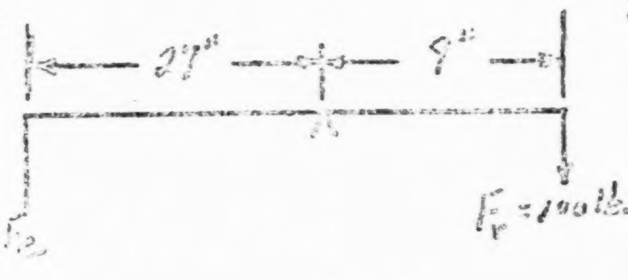
END OF UNIT II

Name_______________________________ Date______

Lesson 31

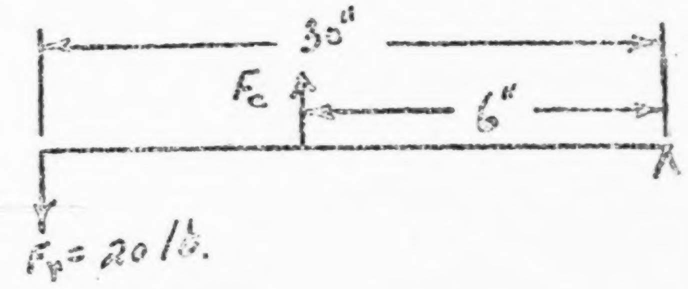
Assignment: In each of the following diagrams determine the requested quantities.

1.



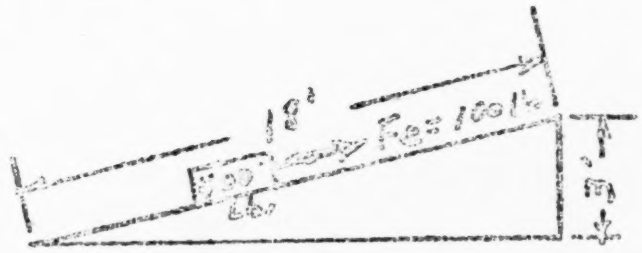
Fe = ___ IMA = ___

2.



Fe = ___ IMA = ___

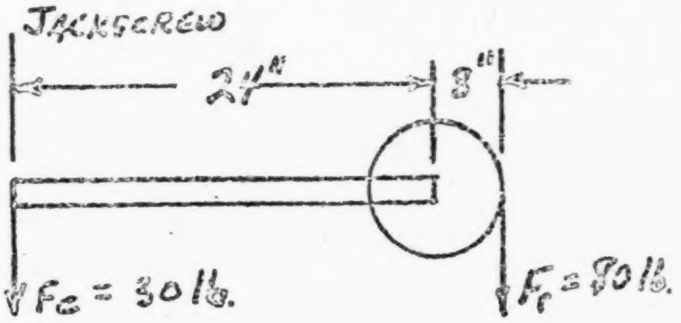
3.



IMA = ___ Win = ___ Eff = ___

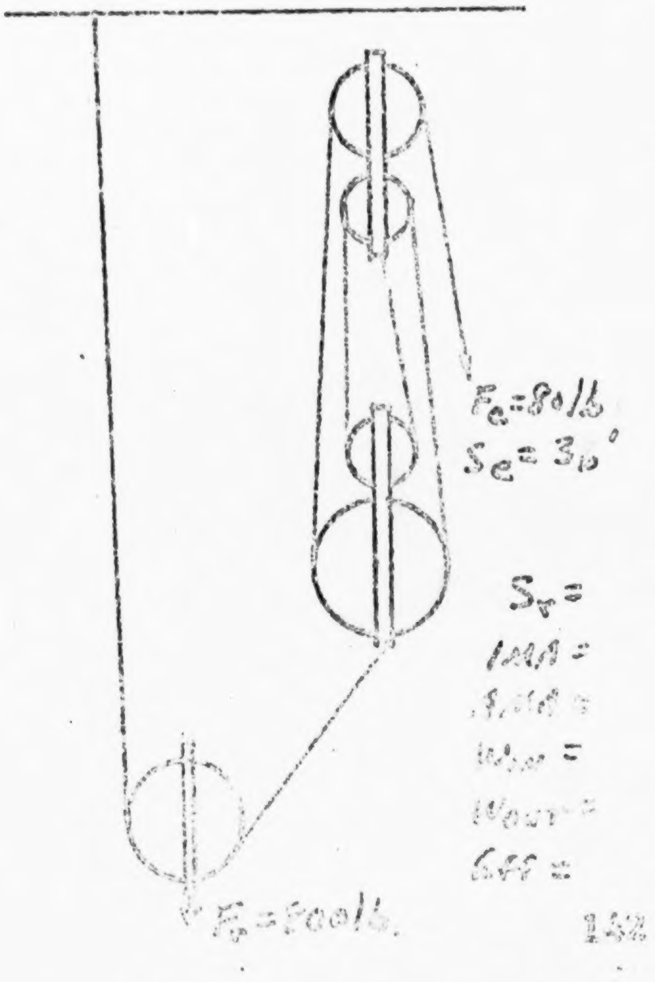
AMA = ___ Wout = ___

4.



IMA = ___ AMA = ___ Eff = ___

5.



Sr =

IMA =

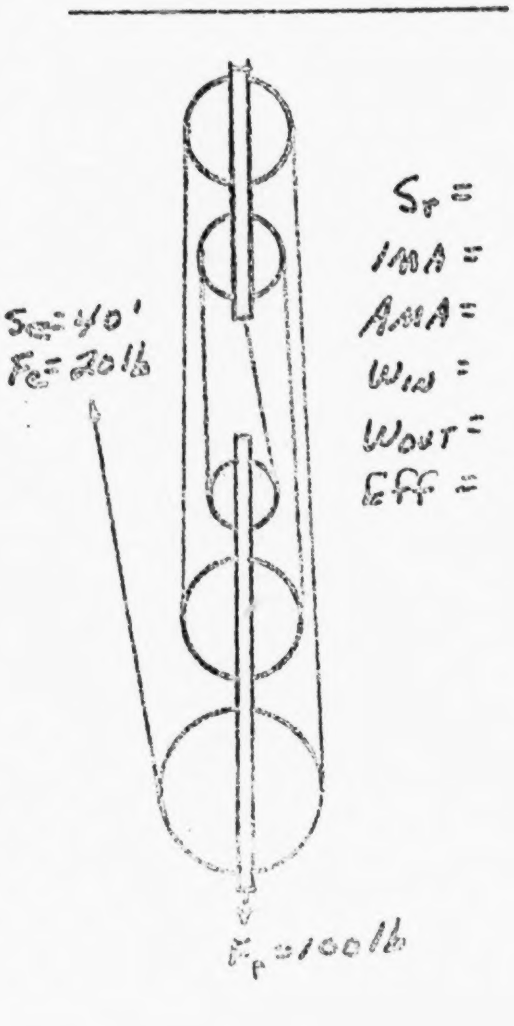
AMA =

Win =

Wout =

Eff =

6.



Sr =

IMA =

AMA =

Win =

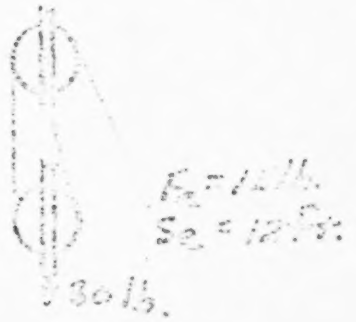
Wout =

Eff =

Name________________________________ Date________

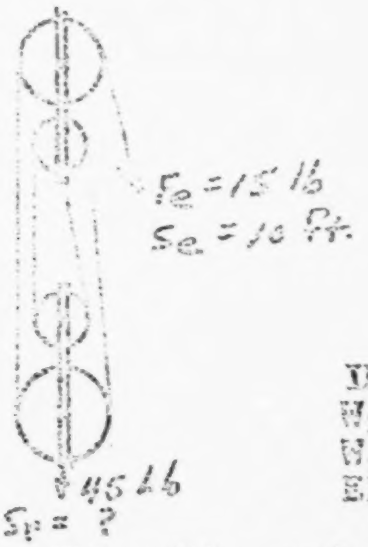
Lesson 31
Classwork and Assignment: Determine for each pulley system the I.M.A., work input, work output, and efficiency.

1.



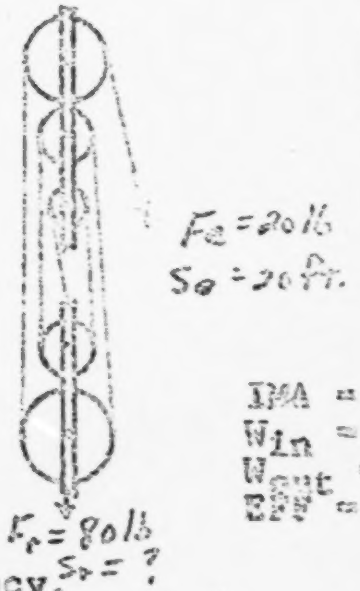
IMA =
Win =
Wout =
EFF =

2.



IMA =
Win =
Wout =
EFF =

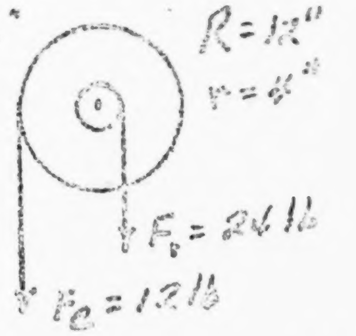
3.



IMA =
Win =
Wout =
EFF =

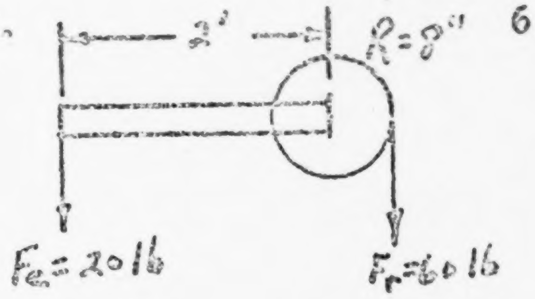
Determine for each system the IMA, AMA, and efficiency.

4.



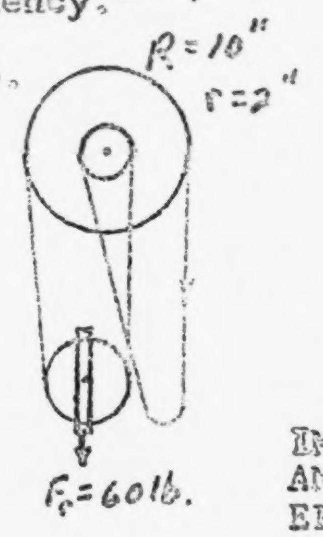
IMA =
AMA =
EFF =

5.



IMA =
AMA =
EFF =

6.



IMA =
AMA =
EFF =

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Lesson 32

Classwork: On a separate sheet of paper set up a diagram for each problem and solve it in a neat and orderly manner.

1. A 200 lb. barrel is rolled up a plank 8 ft. long into a truck 3 ft. high. How much effort is required if friction is neglected?

2. A man can exert a force of 120 lb. and has to load a 360 lb. weight into a truck 4 ft. high. How long a plank will he need if friction is eliminated by using rollers?

3. A truck body weighing 1½ tons is to be loaded onto a platform 4 ft. high by means of planks 20 ft. long. Nelgecting friction, what force must be exerted parallel to the planks in order to move the yacht?

4. What effort applied at the end of an arm 20 inches long is needed to raise a 2500 lb. weight by means of a jackscrew with a pitch of .25 in. if friction is neglected?

5. How much weight can be lifted by an effort of 8 lb. applied at the end of a jackscrew handle 22 in. long if the pitch of the screw thread is .50 in. and friction is neglected?

6. What is the pitch of a jackscrew which can lift a 2½ ton weight with an effort of 8 lb. applied at the end of a rod 24 inches long? Neglect friction.

7. In each of the problems friction was eliminated and you worked with the ideal situation. Following are the efficiencies of each machine. From this information determine the actual value measuring in each problem.

1. 80% 2. 90% 3. 70% 4. 40% 5. 50% 6. 25%.

Introduction to Electricity

Lesson 1

I. General review of algebra.

A. Prime factorization
1. Prime numbers
2. Composite numbers
3. Classwork:
a. Find prime factorization of following:
i. 18
ii. 42
iii. 756
iiii. 12600

B. Lowest Common Multiple (L. C. M.)
1. Use of prime factorization
2. Selection of prime numerals required for L. C. M. of two numerals.

C. Exponents-Scientific Notation
1. Factors (numbers to be multiplied)
a. Writing of five equal factors of x:
i. $(x)(x)(x)(x)(x)$
ii. x^5
b. Terminology:
i. Base, exponent, power.
c. Classwork: Write in exponent form and explain:
i. $(5)(5)(5)$
ii. $(8)(8)(8)(8)(8)(8)$
iii. $(2)(2)(2)(5)(5)(11)(11)(11)$
d. Find prime factorization of the following numbers expressing results in exponential form:
i. 72
ii. 2600

2. Powers of 10
a. 5 factors of 10 may be written as 10^5

b. 32 factors of 10 = 10^{32}

c. 158 factors of 10 = 10^{158}

3. Scientific Notation: $N = m \times 10^a$ where $1 < m < 10$ and "a" is an integer.

a. Example: 356 = N, then m = 3.56 and "a" = 2.

For $N = m \times 10^a$

$356 = 3.56 \times 10^2$

b. Classwork: Write in scientific notation the following numbers"
i. 85
ii. 988
iii. 38,462
iiii. 18,046,904

IV

Name______________________________ Date_____

Lesson 1

Classwork and assignment:

For exercises 1 - 10, find the prime factorization of each given integer.

1. 36
2. 48
3. 27
4. 54
5. 64
6. 81
7. 75
8. 84
9. 52
10. 144

For exercises 11 - 20, find the Least Common Multiple of each set of numbers.

11. 3,4,2
12. 4,6
13. 4,6,9
14. 12,8,3
15. 18,8
16. 6,5,4
17. 8,6,5
18. 12,8,4
19. 10,5,4
20. 15,10,6

For exercises 21 - 30, write each given number in scientific notation.

21. 57
22. 570
23. .57
24. 8,500
25. .07
26. 35,700
27. .025
28. .0025
29. .35700
30. .0000735

Lesson 1 (continued)

D. Classwork and Assignment: Ditto sheet on
   1. Prime factorization
   2. L. C. M.
   3. Scientific notation

Lesson 2

I. General review of algebra.

   A. Quiz
      1. A problem for prime factorization → 1764
      2. Find L. C. M. → 18; 54; 126
      3. Write in Sc. notation → 802; 641

   B. Review quiz and homework.

   C. Negative numbers--Negative exponents.
      1. Number line
         a. Division numbers or number line
         b. Powers of 10 for numbers less than 1 and greater than 0.
         c. Example: Express .65 in scientific notation.

         Since $N = .65$, then $m = 6.5$ For the definition $N = m \times 10^a$, we arrive at -1 for "a".

         Thus $.65 = 6.5 \times 10^{-1}$ where $10^{-1} = \frac{1}{10}$

         d. Classwork: Express the following numbers in scientific notation:
            i. .87
            ii. .087
            iii. .0087
            iiii. .8007
            v. .08007
            vi. .0000000087

         e. General rule for determining value of "a" in

         $N = m \times 10^a$ by number of places the decimal point is moved.

   D. Review rules for solving simple equations.

      1. $3x = 9$
         a. Divide both numbers by coefficent of x.

      2. $ax = b$, solve for x
         a. Divide both numbers by coefficent of x.

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Lesson 2

Classwork and assignment

For each exercise find the lowest common denominator of the given set of fractions and then convert each fraction to an equivalent fraction with the common denominator.

1. $\frac{3}{4} + \frac{1}{6}$
2. $\frac{1}{6} + \frac{5}{9}$
3. $\frac{5}{8} + \frac{1}{5}$
4. $\frac{1}{4} + \frac{3}{8} + \frac{1}{2}$
5. $\frac{8}{15} + \frac{3}{10} + \frac{1}{6}$
6. $\frac{3}{8} + \frac{1}{6} + \frac{3}{5}$
7. $\frac{1}{6} + \frac{7}{15} + \frac{1}{4}$
8. $\frac{8}{15} + \frac{3}{10} + \frac{5}{6}$

For each exercise, by using the lowest common denominator add the fractions.

9. $\frac{1}{6} + \frac{3}{8}$
10. $\frac{5}{12} + \frac{2}{9}$
11. $\frac{7}{15} + \frac{5}{12}$
12. $\frac{1}{8} + \frac{5}{12}$
13. $\frac{1}{12} + \frac{1}{15}$
14. $\frac{1}{18} + \frac{1}{21}$
15. $\frac{1}{24} + \frac{1}{18}$
16. $\frac{1}{27} + \frac{1}{24}$

For each exercise, solve for the unkno

17. Find E when E = IR and I = 3, R = 8.
18. Find I when E = IR and E = 120, R = 5.
19. Solve for R interms of E and I; E = IR
20. Solve for I: E = IR
21. Solve for E when $\frac{E}{I} = R$
22. Solve for I when $\frac{E}{I} = R$
23. Solve for R when $\frac{E}{R} = I$
24. Solve for R when $\frac{E}{R} = I$ and E = 220, I = 11.
25. Solve for E when $\frac{E}{[illegible]} = \frac{[illegible]}{[illegible]}$ 148
26. Solve for I when $\frac{X}{I} = \frac{R}{E}$

Lesson 2 (continued)

3. $\frac{x}{3} = 9$
   a. Multiply both members by the denominator or divisor of x.

4. $\frac{x}{a} = b$, solve for x
   a. multiply both members by "a".

5. $x-2 = 8$
   a. Add 2 to both members.

6. $x-a = b$, solve for x
   a. Add "a" to both members.

7. $x + 2 = 8$
   a. Subtract 2 from both members.

8. $x + a = b$, solve for x
   a. Subtract "a" from both members.

9. Discuss use of letters in place of numerals.

E. Classwork: Solve for given unknown (ditto sheet).

Lesson 3

I. General review of algebra.

A. Changing equation to equivalent equations.

1. $E = IR \Leftrightarrow \frac{E}{I} = R \Leftrightarrow \frac{E}{R} = I$
   a. Develop by algebraic rules.

B. Quiz: (1) Solve for x when $9 = \frac{3x}{2}$

(2) Solve for x when $P = \frac{Ax}{L}$

C. Review quiz.

1. Compare solution of 1 and 2 of quiz.
   a. Stress same method for solving 1 and 2.

2. Classwork:
   a. If $P = \frac{AR}{L}$, solve for R.
   b. If $P = \frac{AR}{L}$, solve for A.
   c. If $P = \frac{AR}{L}$, solve for L.

d. If $P = \frac{AR}{L}$, and $P = 75$, $A = 25$, $L = 3$ find R.

e. If $P = \frac{AR}{L}$, and $A = 16$, $R = 4$, $P = 32$, find L.

3. Discuss: Given the formula $P = \frac{AR}{L}$, other forms (equivalent forms) may be found with the use of algebraic laws.

   a. Usefulness of algebra to simplify equation-solving and memory work.

D. Simplifying fractional equations.

1. Review simplifying: $\frac{1}{2} + \frac{1}{3}$
   a. Use of L.C.M.
   b. Mult. property of 1.

2. Simplify $\frac{1}{\frac{1}{2} + \frac{1}{3}}$

   a. Discuss vinculum.

      i. $\frac{1}{\frac{1}{2} + \frac{1}{3}} \Leftrightarrow \frac{1}{(\frac{1}{2} \quad \frac{1}{3})}$

3. Classwork simplifying complex fractions:

   a. $\frac{1}{\frac{1}{2} + \frac{1}{4}}$

   b. $\frac{1}{\frac{1}{3} + \frac{1}{5}}$

   c. $\frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$

   d. $\frac{1}{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}$

   e. $\frac{1}{\frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \frac{1}{8}}$

   f. $\frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}}$

      i. Stress use of Mult. property of 1 and L.C.M.

E. Classwork and Assignment on ditto sheet.

Lesson 4

I. General review of algebra.

A. Quiz:
Simplify: 1. $\frac{1}{\frac{1}{5} + \frac{1}{15}}$

2. $\frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$ where $R_1 = 6$
$R_2 = 9$

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Lesson 3

Assignment:

For exercises 1 - 8, find the lowest common denominator of the given set of fractions, then find their sum.

1. $\frac{1}{4} + \frac{1}{18}$

2. $\frac{3}{8} + \frac{5}{18}$

3. $\frac{7}{15} + \frac{5}{21}$

4. $\frac{1}{22} + \frac{1}{24}$

5. $\frac{1}{15} + \frac{1}{18}$

6. $\frac{1}{16} + \frac{1}{18}$

7. $\frac{1}{12} + \frac{1}{16}$

8. $\frac{1}{20} + \frac{1}{24}$

For exercises 9 - 12, simplify the complex fraction.

9. $\dfrac{1}{\frac{1}{3} + \frac{1}{4}}$

10. $\dfrac{1}{\frac{1}{4} + \frac{1}{6}}$

11. $\dfrac{1}{\frac{1}{8} + \frac{1}{6} + \frac{1}{3}}$

12. $\dfrac{1}{\frac{1}{4} + \frac{1}{6} + \frac{1}{8}}$

For exercises 13 - 18, find the value of the variable indicated in terms of the other values.

13. $Y = \dfrac{1}{\frac{1}{x} + \frac{1}{z}}$ If $x = 6$, $z = 8$

14. $Y = \dfrac{1}{\frac{1}{x} + \frac{1}{z}}$ If $x = 12$, $z = 10$

15. $Y = \dfrac{1}{\frac{1}{x} + \frac{1}{z}}$

If $x = 15$ and $z = 9$.

16. $R_T = \dfrac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$

If $R_1 = 8$ and $R_2 = 10$.

17. $R_T = \dfrac{1}{\frac{1}{R_1} \quad \frac{1}{R2}}$

If $R_1 = 8$ and $R_2 = 4$.

18. $R_T = \dfrac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$

If $R_1 = 12$ and $R_2 = 8$.

Lesson 4 (continued)

B. Review simplifying complex fractions.
   1. Use of L.C.M.
   2. Use of Mult. property of 1.
      a. Demonstrate on board:
         i. $\dfrac{1}{\frac{1}{3}+\frac{1}{5}+\frac{1}{7}}$
         ii. $\dfrac{1}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}}$
      b. Classwork:
         i. $\dfrac{1}{\frac{1}{4}+\frac{1}{9}}$
         ii. $\dfrac{1}{\frac{1}{R_1}+\frac{1}{R_2}}$

C. Review simplifying and solving fractional equations.
   1. Demonstrate on board, solve for y.
      a. $Y = \dfrac{1}{\frac{1}{6}+\frac{1}{8}}$
   2. Classwork: Solve for Y.
      a. $Y = \dfrac{1}{\frac{1}{8}+\frac{1}{10}}$
      b. $Y = \dfrac{1}{\frac{1}{m}+\frac{1}{n}}$
   3. Demonstrate on board; solve for "a".
      a. $a = \dfrac{1}{\frac{1}{x}+\frac{1}{y}}$ where $x = 5$ and $y = 9$
      b. $x = \dfrac{1}{\frac{1}{a}+\frac{1}{y}}$ where $x = 2$ and $y = 4$

D. Classwork and Assignment: Ditto sheet.

Lesson 5

I. Fractional equation.

A. Quiz:

1. Solve for K when $a = 8$ and $b = 4$.

$$K = \frac{1}{\frac{1}{a}+\frac{1}{b}}$$

2. Solve for a when $K = 9$ and $b = 6$.

$$a = \frac{1}{\frac{1}{K}+\frac{1}{b}}$$

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Lesson 4

Quiz

1. Simplify $\dfrac{1}{\dfrac{1}{5} + \dfrac{1}{15}}$

2. Solve for R_T: $R_T = \dfrac{1}{\dfrac{1}{R_1} + \dfrac{1}{R_2}}$ when $R_1 = 6$, $R_2 = 9$.

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Lesson 4
Classwork and Assignment

For exercises 1 - 5 simplify the complex fraction using the multiplication property of 1.

1. $\frac{1}{\frac{1}{3}+\frac{1}{8}}$

2. $\frac{1}{\frac{1}{3}+\frac{1}{6}}$

3. $\frac{1}{\frac{1}{12}+\frac{1}{15}}$

4. $\frac{1}{\frac{1}{6}+\frac{1}{10}}$

5. $\frac{1}{\frac{1}{12}+\frac{1}{18}}$

For exercises 6 - 10, solve for the value of the variable indicated in terms of the other values.

6. $a = \frac{1}{\frac{1}{x}+\frac{1}{y}}$ If $x = 8$, $y = 12$

7. $x = \frac{1}{\frac{1}{b}\quad\frac{1}{c}}$
If $b = 12$, $c = 15$

8. $a = \frac{1}{\frac{1}{x}+\frac{1}{y}}$
If $x = 10$, $y = 12$

9. $R_T = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}}$ If $R_1 = 4$, $R_2 = 6$, $R_3 = 9$

10. $R_T = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}}$
If $R_1 = 8$, $R_2 = 12$, $R_3 = 15$

For exercises 11 - 15, solve for R_T in terms of the values of the other variables given.

$$R_T = \frac{1}{\frac{1}{R_1}\quad\frac{1}{R_2}\quad\frac{1}{R_3}}$$

11	R_1	R_2	R_3
12	6	10	12
13	8	10	12
14	3	8	12
15	9	12	15

Lesson 5 (continued)

B. Review assignment for ditto sheet.
    1. Problem on board.

C. Classwork
    1. Continue ditto sheet (6 to 10).

C. Assignment: Complete ditto sheet (6 to 10).

Lesson 6

I. Fractional equations.

A. Quiz: Solve for R_1 when $R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$

$R_T = 4$ and $R_2 = 12$

B. Review quiz.
    1. Stress need to list all steps.

C. Review assignment.
    1. Neatness and step-by-step development in solving for unknown.
        a. Stress laws of equation solving.

D. Assignment: Complete ditto sheet. Announce test.

Lesson 7

I. Fractional equations.

A. Review homework.

B. Classwork (Ditto sheet)
    1. Teacher supply answers on board and help pupils at their desks.
    2. Review problems on ditto sheet.
        a. Ohm's Law
            i. Changing $\frac{E}{I} = R$ to other forms.
        b. Finding R_T in a series circuit.
        c. Finding R_T in a parallel circuit.
            i. Finding individual resistance values given R_T and R_I's.
        d. Finding resistivity.

C. Assignment: Complete ditto sheet.

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Lesson 7
Classwork and assignment

For exercises 1 - 4 refer to the formula for Ohm's law: $\frac{E}{I} = R$

1. Find R if I = 12, E = 30.
2. Find I if E = 40, R = 16.
3. Find E if I = 12, R = 5.
4. Find I if R = 7, E = 56.

For exercises 5 - 8 refer to the formula for series circuit: $R_T = R_1 + R_2 + R_3 + R_4$. Find the missing value.

Exercise	R_1	R_2	R_3	R_4	R_T
5	3	12	7	5	
6	7		3	8	24
7	12	15		18	64
8	18		14	23	72

For exercises 9 - 12 refer to the formula for parallel circuits: Find the missing values.

$$R_T = \frac{1}{\frac{1}{R_1} \quad \frac{1}{R_2} \quad \frac{1}{R_3}}$$

Exercise	R_1	R_2	R_3	R_T
9	6	8	10	
10	3	4	5	
11	8	12	9	
12	5	6	8	

Lesson 8

I. General review of algebra.

- A. Review of:
  - 1. Prime and composite numbers.
    - a. L.C.M.
  - 2. Scientific notation.
  - 3. Simplifying equations.
- B. Review ditto sheet assignment.
- C. General discussion/review for tomorrow's test.
- D. Assignment: Study for test.

Lesson 9

I. Test

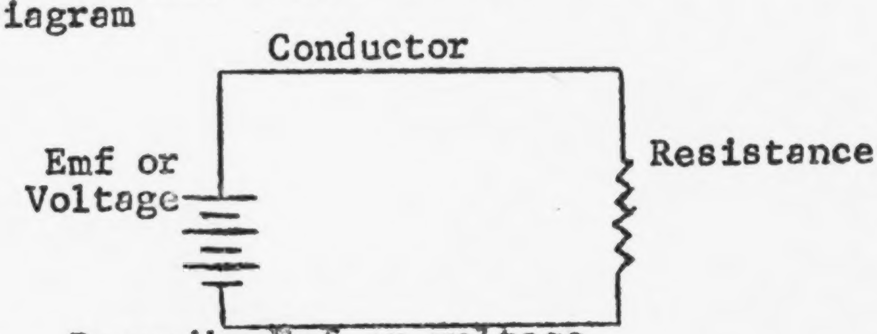
Lesson 10

I. General review of algebra.

- A. Review test.

II. Introduction to electrical circuits.

- A. Simple circuit, single resistance.
  - 1. Diagram



    - a. Describe Emf or voltage.
      - i. Generator
      - ii. Battery
    - b. Conductor
      - i. Metals
        - (1) Liken to a pipe or garden hose.
    - c. Resistance
      - i. Light bulb
      - ii. Toaster or electric heater
  - 2. Definition of Ohm's Law
    - a. $\frac{E}{I} = R$
    - b. Relate to diagram and assign values to 2 unknowns and solve for 3rd unknown.

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Lesson 9

Test.

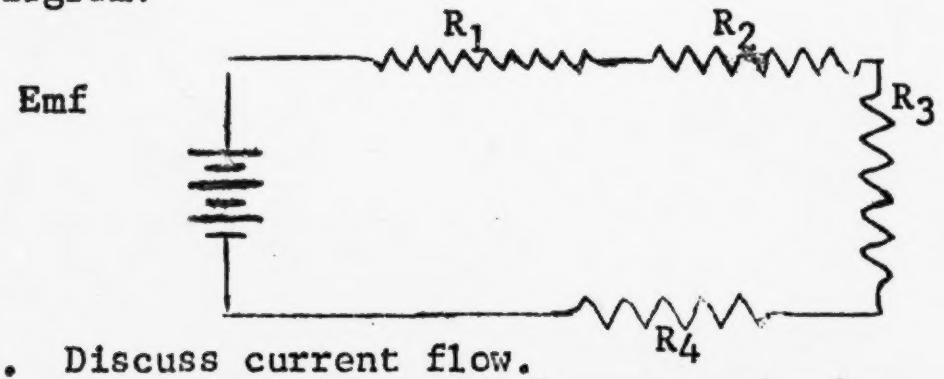
1. Find the least common multiple of 18 and 24.
2. Find the lowest common denominator of $\frac{1}{15}$ and $\frac{1}{18}$.
3. Write in scientific notation: 3750.
4. Solve for x is $ax = c$ and $a = 5$, $c = 18$.
5. Solve for k when $\frac{1}{k} = m$.
6. If $P = \frac{AR}{L}$ and $A = 16$, $R = 4$, and $P = 32$, find L.
7. Simplify the fraction to a common fraction: $\frac{1}{\frac{1}{6} + \frac{1}{15}}$
8. Simplify this complex fraction to a common fraction:

$$\frac{1}{\frac{1}{5} + \frac{1}{8} + \frac{1}{12}}$$

9. Solve for R_T when: $R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$ and $R_1 = 8$, $R_2 = 12$.
10. Solve for R_1 when $R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$ and $R_2 = 8$, $R_T = 4$.

Lesson 10 (continued)

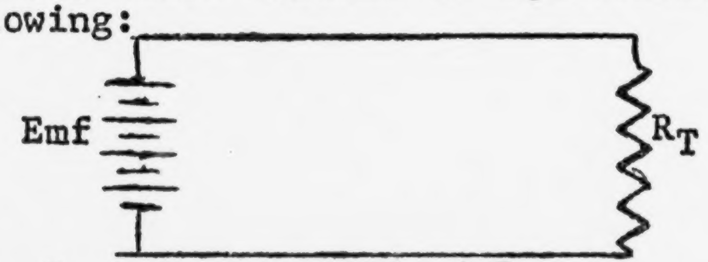
B. Series circuit.
  1. Diagram:



    a. Discuss current flow.
      i. Relate to water flow through pipes.
      ii. Total current flows through each R_I.

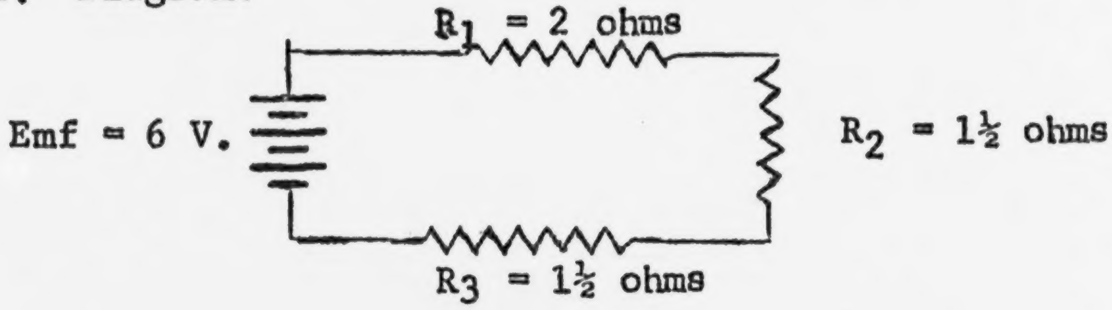
    b. Total resistance of circuit is equal to the sum of all the resistances.
      i. $R_T = R_1 + R_2 + R_3 + R_4$

    c. Thus the above circuit is equivalent to the following:



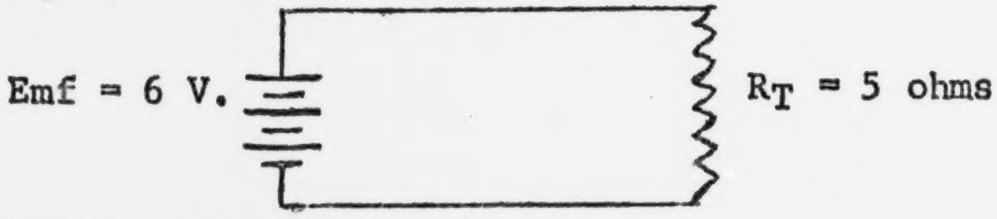
where $R_T = R_1 + R_2 + R_3 + R_4$

  2. Example: Reduce the following series circuit to an equivalent circuit containing only one resistor.
    a. Diagram:



      i. Since: $R_T = R_1 + R_2 + R_3$ we have
R_T = 2 ohms + $1\frac{1}{2}$ ohms + $1\frac{1}{2}$ ohms
R_T = 5 ohms

    b. Equivalent circuit.



Symbol for ohm is Ω

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Lesson 10
Classwork and assignment

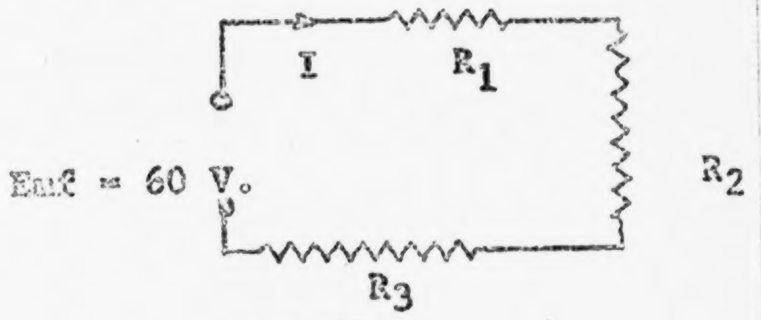


FIGURE 1

1. In Figure 1, if $R_1 = 2\ \Omega$, $R_2 = 3\ \Omega$, and $R_3 = 5\ \Omega$.
Find: R_T, I, E_1, E_2, and E_3.

2. In Figure 1, if $R_1 = 1\ \Omega$, $R_2 = 6\ \Omega$, and $R_3 = 8\ \Omega$.
Find R_T, I, E_1, E_2, and E_3.

3. In Figure 1, if $R_1 = 3\ \Omega$, $R_2 = 5\ \Omega$. $_3 = 4\ \Omega$,
Find R_T, I, E_1, E_2, and E_3.

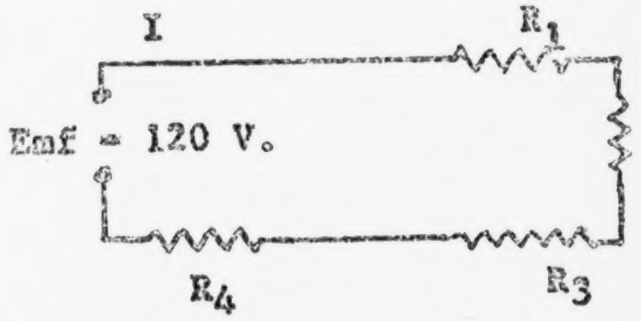


FIGURE 2

4. In Figure 2, if $R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 2\ \Omega$, $R_4 = 4\ \Omega$,
Find R_T, I, E_1, E_2, E_3, and E_4.

5. In Figure 2, if $R_1 = 4\ \Omega$, $R_2 = 5\ \Omega$, $R_3 = 4\ \Omega$, and $R_4 = 6\ \Omega$, $R_5 = 7\ \Omega$, find R_T, I, E_1, E_2, E_3, and E_4.

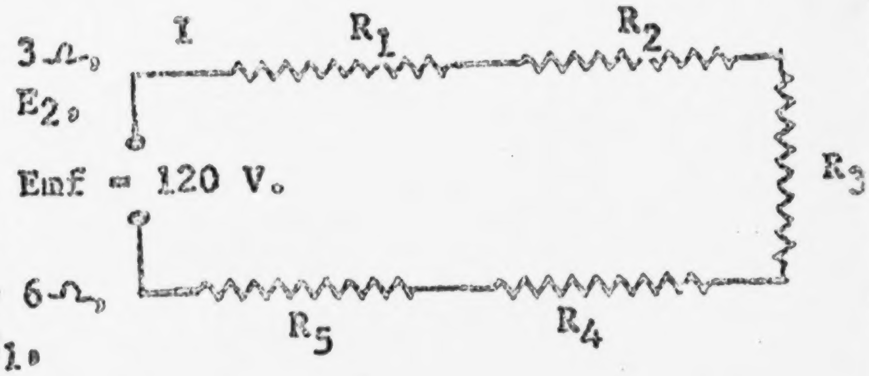


FIGURE 3

6. In Figure 3, if $R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 2\ \Omega$, $R_4 = 3\ \Omega$, $R_5 = 1\ \Omega$, find R_T, I, E_1, E_2, E_3, E_4, E_5.

7. In Figure 3, if $R_1 = 3\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 5\ \Omega$, $R_4 = 6\ \Omega$, $R_5 = 2\ \Omega$, find: R_T, I, E_1, E_2, E_3, E_4, E_5.

Lesson 10 (continued)

c. Find the current that flows thru the above circuit:

   i. Since $\frac{E}{I} = R \Rightarrow \frac{E}{R} = I$ where E = Emf, R = resistance and I = current, we have $\frac{E}{R} = I \Rightarrow \frac{6\ V.}{5\ \Omega} = I$ or $I = \frac{6}{5}$, or $1\frac{1}{5}$ amps.

d. Find the Emf across R_1.

   i. Since $R_1 = 2\ \Omega$ and $I = \frac{6}{5}$ amps and $\frac{E}{I} = R$; $E_1 = IR$ we have $E = \frac{6}{5} \times 2$ or $\frac{12}{5}$ or $2\frac{2}{5}$ volts.

   ii. Likewise find Emf across R_2.

   iii. Likewise find Emf across R_3.

e. Determine sum of $E_1 + E_2 + E_3$

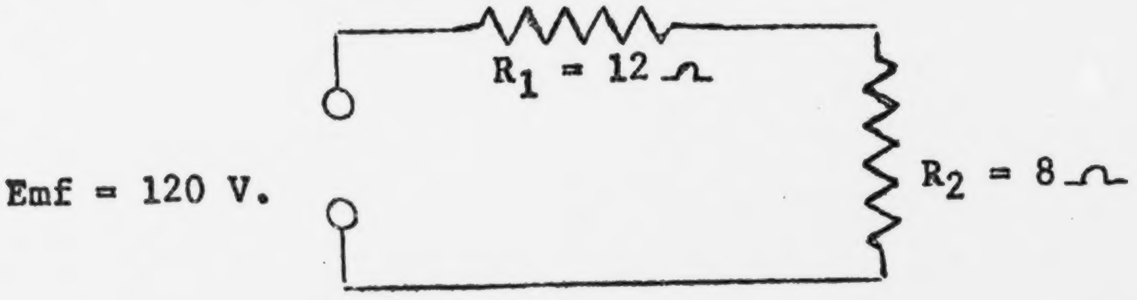
   i. $E_T = E_1 + E_2 + E_3$

C. Classwork and Assignment: Ditto sheet.

Lesson 11

I. Series circuits.

   A. Review of series hookup.
      1. Simplify the following series hookup.
         Find: E_1, E_2,; R_T and I



   B. Classwork and assignment: Ditto sheet.
      1. All series hookups.
         a. Single resistor
         b. Double resistor

Name_______________________________ Date______

Lesson 11

Classwork and assignment.

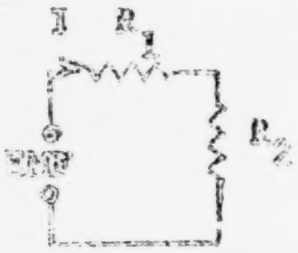


FIGURE 1

1. In Figure 1, if EMF = 120V, I = 5 amps, R_1 = 20Ω, find: R_2

2. In Figure 1, if EMF = 120V, I = 6 amps, R_1 = 14Ω, find: R_2

3. In Figure 1, if I = 8 amps, R_1 = 4Ω, R_2 = 23Ω, find: EMF.

4. In Figure 1, simplify the series circuit if R_1 = 5Ω, and R_2 = 3Ω.

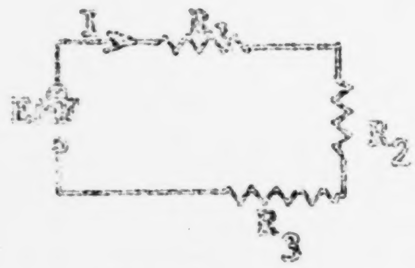


FIGURE 2

5. In Figure 2, if EMF = 60V, I = 5 amps, R_1 = 6Ω, and R_2 = 8Ω, find: R_3

6. In Figure 2, if I = 5 amps, R_1 = 5Ω, R_2 = 1Ω, and R_3 = 4Ω, find EMF.

7. In Figure 2, simplify the series circuit if R_1 = 6Ω, R_2 = 4Ω, and R_3 = 5Ω.

8. In Figure 3, simplify the series circuit if R_1 = 15Ω, R_2 = 3Ω, R_3 = 8Ω, R_4 = 10Ω, and R_5 = 16Ω.

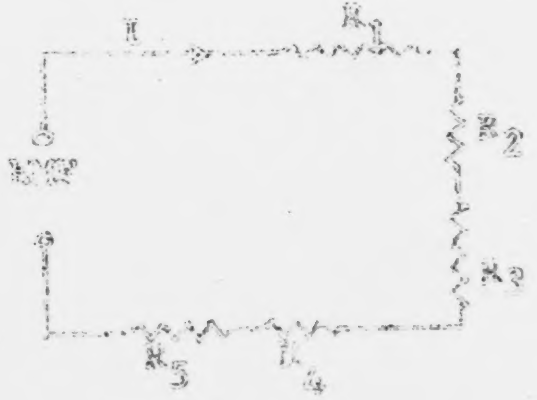
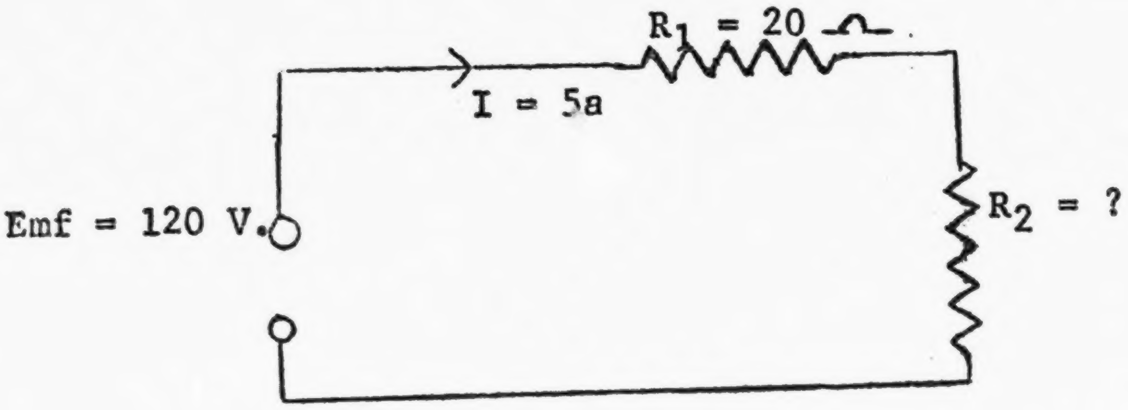


FIGURE 3

Lesson 11 (continued)

c. Example: Find values as in review above.
also: Given Emf = 120 V.
$I = 5$ amps
$R_1 = 20\ \Omega$
$R_2 = ?$



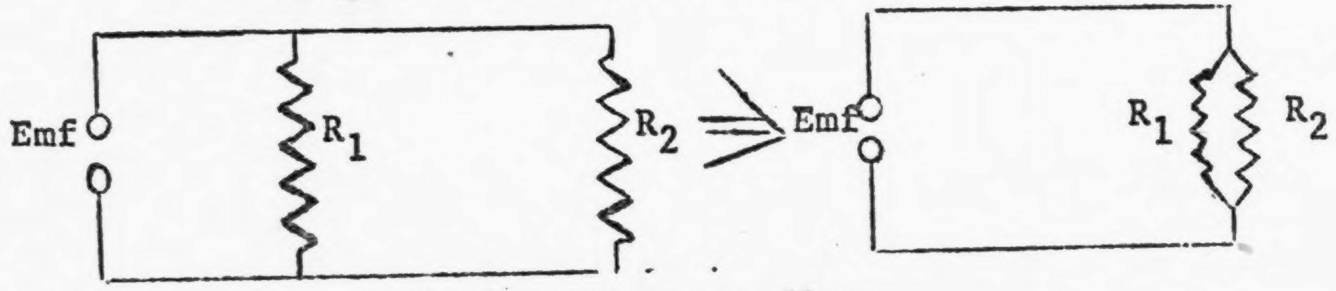
Lesson 12

I. Series Circuit

- A. Quiz (Simplify the following circuit.)
- B. Review assignment.

II. Parallel hookup.

- A. Description:
  - 1. Relate to water pipes and y-branch or T.
    - a. Refer to duct system and y-branches of previous year.
  - 2. Diagram of a simple parallel hookup.



a. Describe electron flow.
i. Value of resistors determine amount of amperes through each branch.

b. If Emf = 144 V. and $R_1 = 16\ \Omega$
and $R_2 = 48\ \Omega$

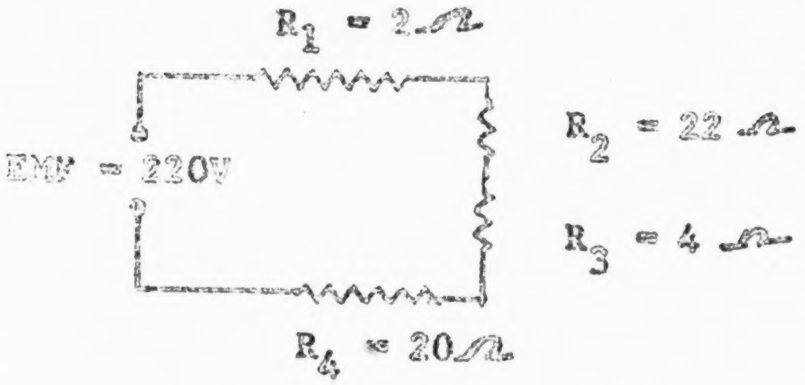
Fine R_T; I; I_1; I_2; of above circuit.
i. Develop on board step by step solution.
ii.
$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

Name______________________________ Date_____

Lesson 12

Quiz

Simplify the following circuit.



Lesson 12

Classwork and assignment.

For each exercise, find R_T for the parallel circuit given.

1. $R_1 = 3\Omega$
   $R_2 = 5\Omega$
   $R_3 = 8\Omega$

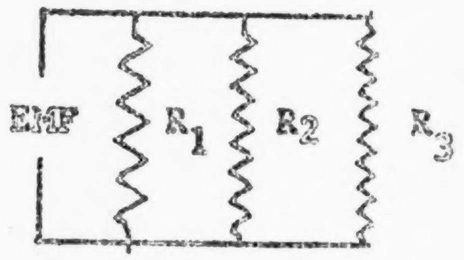
2. $R_1 = 4\Omega$
   $R_2 = 10\Omega$
   $R_3 = 6\Omega$

3. $R_1 = 10\Omega$
   $R_2 = 40\Omega$
   $R_3 = 16\Omega$

4. $R_1 = 9\Omega$
   $R_2 = 12\Omega$
   $R_3 = 8\Omega$

5. $R_1 = 10\Omega$
   $R_2 = 12\Omega$
   $R_3 = 18\Omega$

6. $R_1 = 18\Omega$
   $R_2 = 21\Omega$
   $R_3 = 14\Omega$



Lesson 12 (continued)

B. Classwork: Find R_T of the following parallel hookups. (ditto sheet)

C. Assignment: Complete ditto sheet problems 1 to 5.

Lesson 13

I. Parallel hookup.

A. Quiz

B. Review characteristics of a simple parallel hookup.
  1. Review quiz.
    a. Assign values to Emf and find I_T; I_1; and I_2.
      i. Let Emf = 40 Volts
      ii. Let Emf = 60 Volts

C. Review assignment (Ditto sheet 1 - 5)

D. Classwork and Assignment: Complete ditto sheet 6 - 10.

Lesson 14

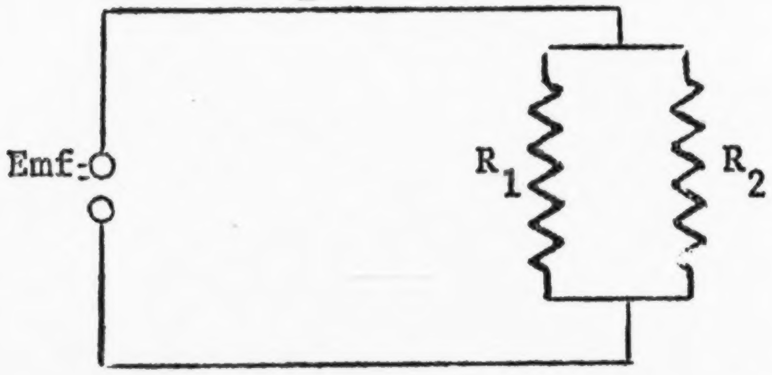
I. Parallel circuit.

A. Quiz

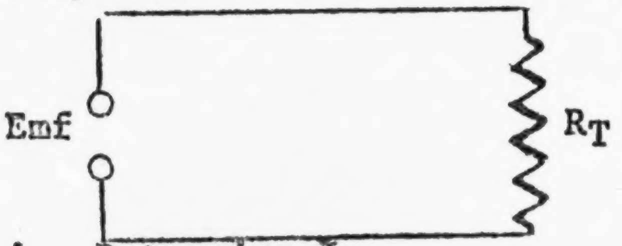
B. Review quiz problem.
  1. Solve for I, I_1, I_2, I_3 when Emf = 120 V.

C. Classwork: Find: R_T, I_T, I_1, I_2.

when Emf = 12 volts
$R_1 = 4\ \Omega$
$R_2 = 12\ \Omega$



1. Simplify above circuit into single resistor "R_T".
  a.



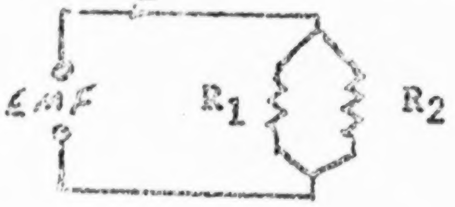
i. Determine I_T

Name________________________ Date_____

Lesson 13

Quiz

Find R_T when R_1 = 8Ω, R_2 = 12Ω.



Lesson 13

Assignment.

Find R_T of the parallel circuit given.

1. R_1 = 5Ω
R_2 = 8Ω
R_3 = 6Ω
R_4 = 4Ω

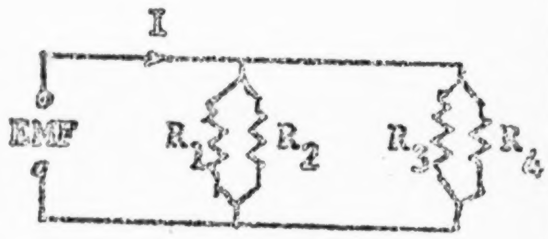
2. R_1 = 6Ω
R_2 = 10Ω
R_3 = 15Ω
R_4 = 12Ω

3. R_1 = 10Ω
R_2 = 35Ω
R_3 = 14Ω
R_4 = 40Ω

4. R_1 = 8Ω
R_2 = 12Ω
R_3 = 18Ω
R_4 = 15Ω

5. R_1 = 22Ω
R_2 = 30Ω
R_3 = 32Ω
R_4 = 24Ω

6. R_1 = 7Ω
R_2 = 14Ω
R_3 = 21Ω
R_4 = 28Ω

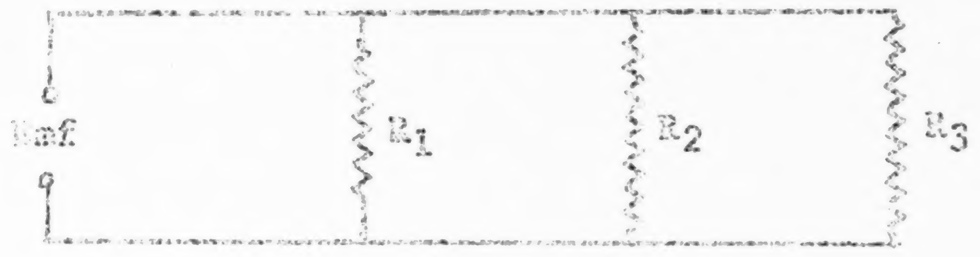


Name________________________________ Date________________

Lesson 14
Quiz

Find: R_T

when: $R_1 = 2\ \Omega$ $R_2 = 4\ \Omega$ $R_3 = 10\ \Omega$



Name________________________________ Date________________

Lesson 14
Classwork and Assignment

1. In Figure 1, if $R_T = 3\ \Omega$, and $R_2 = 6\ \Omega$, find R_1.

2. In Figure 1, if $R_T = 5\ \Omega$, and $R_2 = 10\ \Omega$, find R_1.

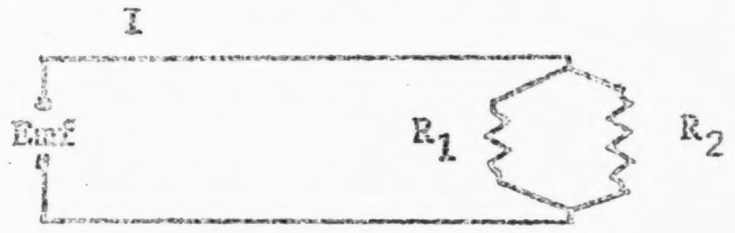


FIGURE 1

3. In Figure 2, if Emf = 6 V., $R_T = 15\ \Omega$, and $R_2 = 30\ \Omega$, find I_T, I_1, I_2, and R_1.

4. In Figure 2, if Emf = 8 V., $R_T = 16\ \Omega$, and $R_2 = 24\ \Omega$, Find I_T, I_1, I_2, and R_1.

FIGURE 2

Lesson 14 (continued)

2. Refer to original diagram and determine I_1 and I_2.
    a. Stress necessity for simplifying parallel hookup into a single "R_T" circuit.
    b. Simplify by using a step-by-step reduction.
        i. First simplify series resistances.
        ii. Then simplify parallel resistances into a single resistor circuit.

C. Assignment: First 5 problems on ditto sheet.

Lesson 15

I. Parallel hookup.

A. Quiz: Find R_T using step-by-step reduction of circuit.

[illegible] [illegible]

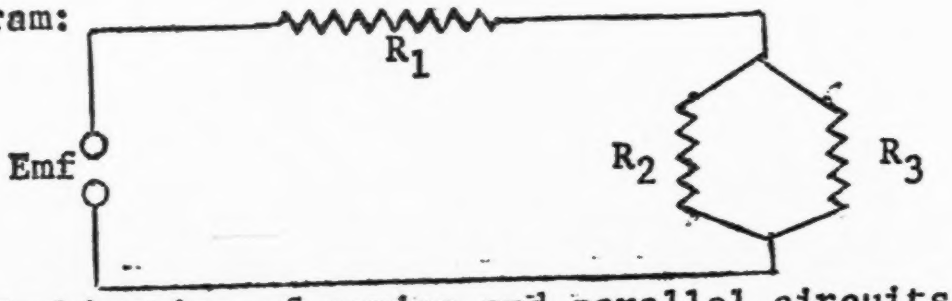
[illegible] [illegible]

B. Review quiz on board.
    1. Solve using detail and save as an example for future reference.

C. Review assignment.
    1. Each problem carefully analyzed at board.
        a. Pupils do development.

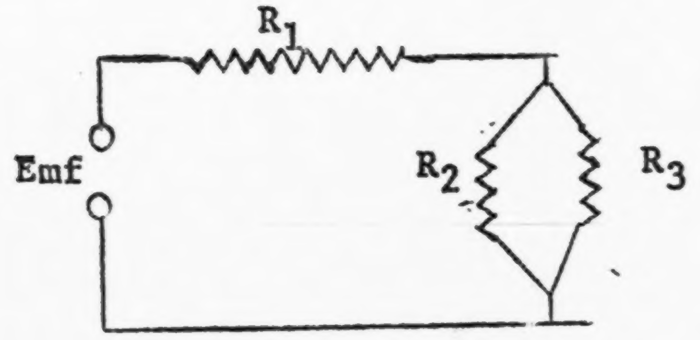
II. Networks

A. Diagram:



1. Combination of series and parallel circuits.
    a. First simplify all parallel hookups.
    b. Then find R_T of remaining series hookup.

2. In the following network solve for R_T when $R_1 = 5\ \Omega$
$R_2 = 6\ \Omega$
$R_3 = 6\ \Omega$



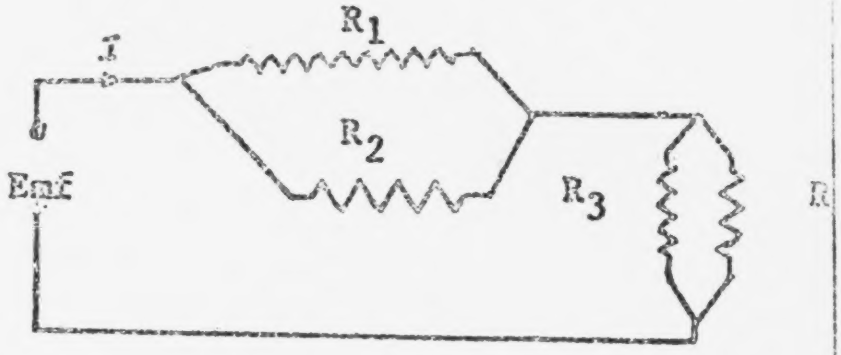
Name________________________________ Date__________________

Lesson 15
Quiz

Find R_T using step-by-step reduction of the circuit.

$R_1 = 1\,\Omega$ $R_2 = 5\,\Omega$

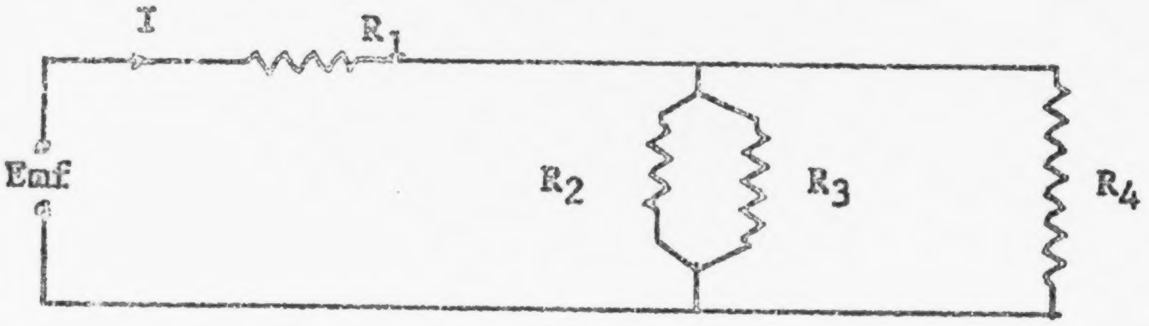
$R_3 = 2\,\Omega$ $R_4 = 5\,\Omega$



Name________________________________ Date__________________

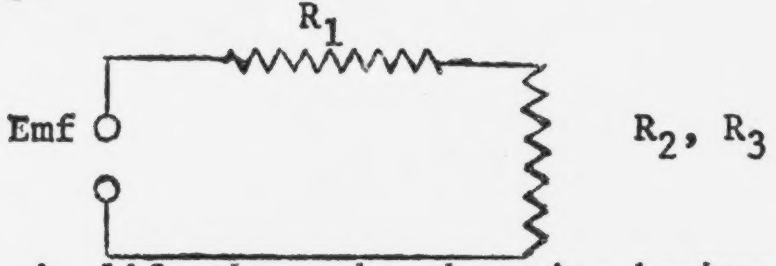
Lesson 16
Quiz

Find R_T if $R_1 = 5\,\Omega$, $R_2 = 6\,\Omega$, $R_3 = 6\,\Omega$, $R_4 = 3\,\Omega$.



Lesson 15 (continued)

a. Simplify the parallel hookup R_2 and R_3 reducing the network into the following series hookup.



b. Then simplify the reduced series hookup into a single resistor circuit.

B. Classwork and Assignment: Complete 6 to 10 on ditto sheet.

Lesson 16

I. Networks

A. Quiz

B. Review quiz and assignment.

C. Class development: In the following network find:

R_T =

Emf over R_1 =

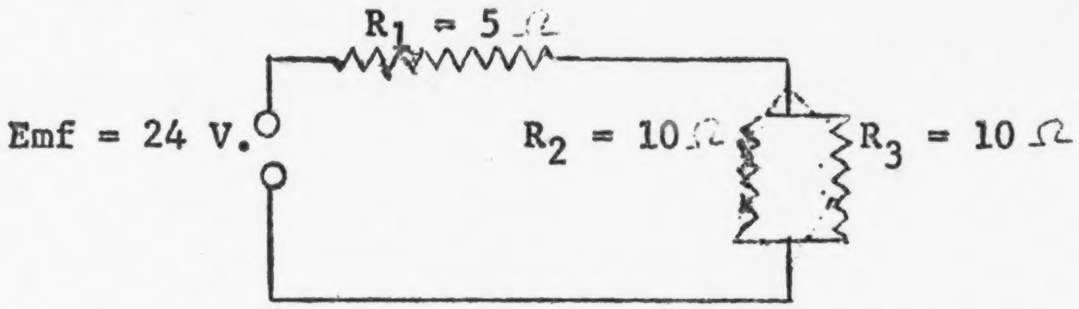
Emf over R_2, R_3 =

I_T =

I_1 =

I_2 =

I_3 =



1. Simplify into a simple two-resistor series hookup.
    a. Discuss electron flow (path).
    b. Current that flows through R_1 must pass through R_2 and R_3.

2. Simplify into a single resistor circuit.
    i. Solve for missing values.

D. Classwork and Assignment: Ditto sheet on networks, #1-3. Announce test.

Name_____________________________________ Date_______

Lesson 15

Assignment

1. In Figure 1, find R_T if
$R_1 = 3\Omega$, $R_2 = 5\Omega$, $R_3 = 6\Omega$,
$R_4 = 2\Omega$.

2. In Figure 1, find R_T if
$R_1 = 4\Omega$, $R_2 = 6\Omega$, $R_3 = 10\Omega$,
and $R_4 = 12\Omega$.

3. In Figure 2, find R_T if
$R_1 = 3\Omega$, $R_2 = 5\Omega$, $R_3 = 6\Omega$,
and $R_4 = 2\Omega$.

4. In Figure 2, find R_T if
$R_1 = 4\Omega$, $R_2 = 6\Omega$, $R_3 = 10\Omega$,
and $R_4 = 12\Omega$.

5. In Figure 3, find R_T if
$R_1 = 3\Omega$, $R_2 = 3\Omega$, $R_3 = 2\Omega$,
and $R_4 = 15\Omega$, $R_5 = 12\Omega$.

6. In Figure 3, find R_T if
$R_1 = 6\Omega$, $R_2 = 12\Omega$, $R_3 = 8\Omega$,
$R_4 = 15\Omega$, and $R_5 = 12\Omega$.

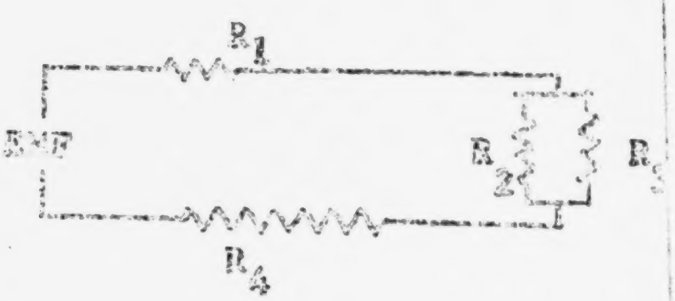


FIGURE 1

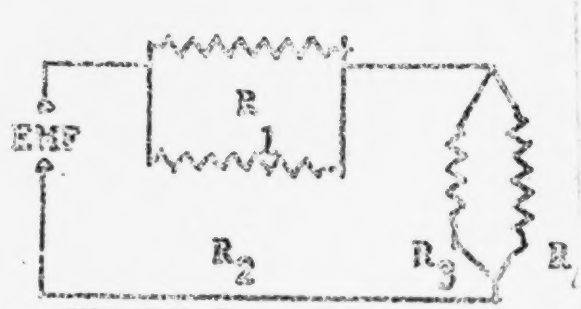


FIGURE 2

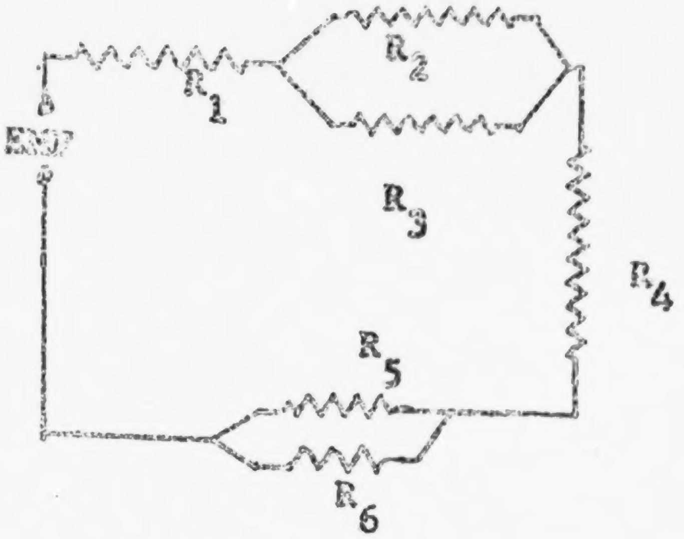
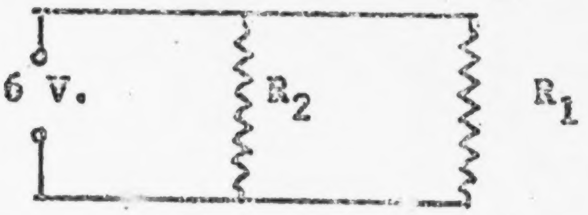


FIGURE 3

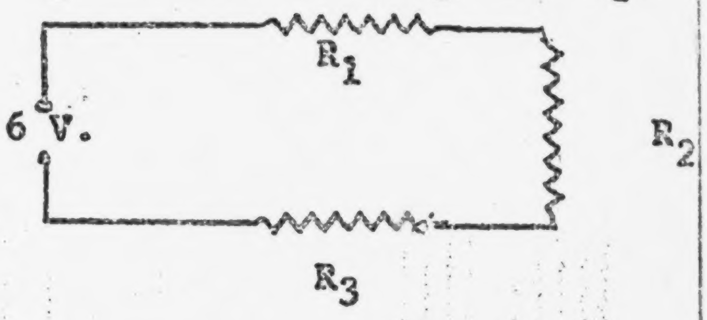
Name________________________________ Date_______________

Lesson 16

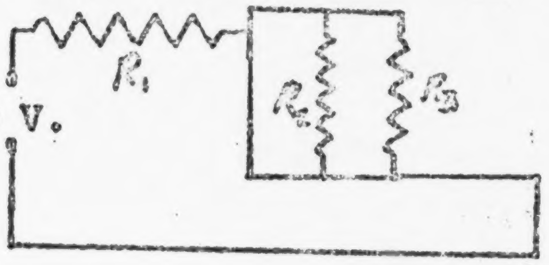
1. When R = 15 Ω and R = 30 Ω. Find I_T, I_1, I_2, R_1.



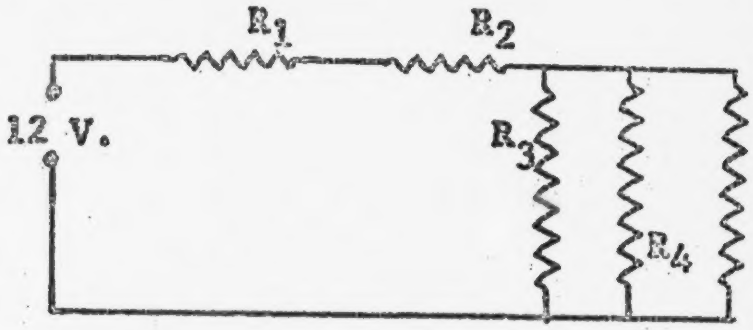
2. When R_1 = 6 Ω, R_2 = 3 Ω, R_3 = 2 Ω. Find I_T, and R_T.



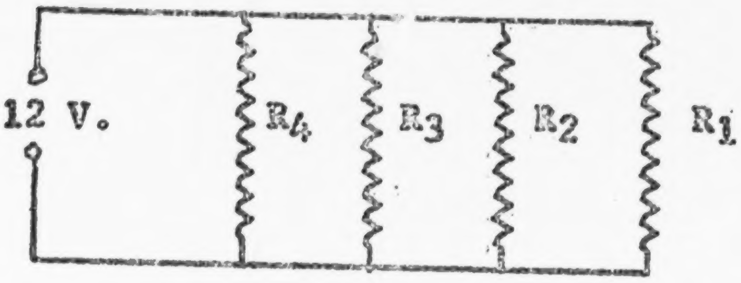
3. When R_1 = 2 Ω, R_2 = 6 Ω, R_3 = 6 Ω, Find R_T, I_T.



4. When R1 = R2 = R3 = R4 = R5 = R6 = 6 Ω. Find R_T, I_T.

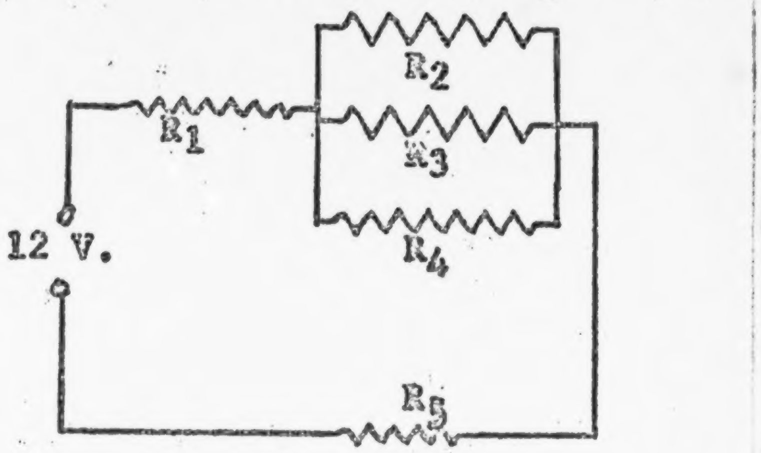


5. When R_1 = 6 Ω, R_2 = 10 Ω, R_3 = 8 Ω, R_4 = 15 .



Find R_T, and I_T.

6. When R_1 = 2 Ω, R_2 = 5 Ω, R_3 = 6 Ω, R_4 = Ω, R_5 = 12 Ω



Find R_T, and I_T.

Lesson 17

I. Networks

A. Review simplifying and solving networks.
   1. IR drop
   2. Electron flow

B. Review assignment on simplifying networks.
   1. Step-by-step development on board by pupils.

C. Classwork and Assignment: Complete 4 to 6 on ditto sheet. Announce test.

Lesson 18

I. Networks

A. Review of simplification of networks.
   1. Have class give description.

B. Review assignment.
   1. Assign pupils to board.

C. Classwork and Assignment: Ditto sheet, review of series. Announce test in 2 days.

Lesson 19

I. Series and parallel circuits; networks, circuitry.

A. Review of:
   1. Series hookup.
   2. Parallel hookup.
   3. Network.

B. Review assignment.

C. Class discussion and questions regarding test.

D. Assignment: Review for test tomorrow.

Lesson 20

I. Test. (Ditto sheet)

Name________________________________ Date_______________

Lesson 20
Test

1. In Figure 1, if $R_1 = 12\,\Omega$, $R_2 = 7\,\Omega$, $R_3 = 15\,\Omega$, and $R_4 = 8\,\Omega$. Find R_T, and I.

2. In Figure 1, if $R_T = 35\,\Omega$, $R_1 = 12\,\Omega$, $R_2 = 7\,\Omega$, and R3 = $8\,\Omega$. Find R_4 and I.

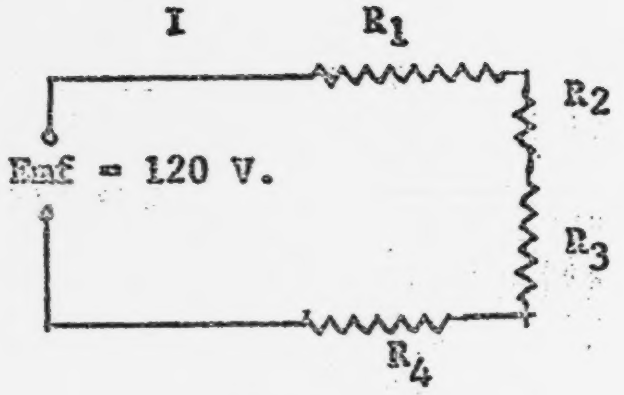


FIGURE 1

3. In Figure 2, if $R_1 = 12\,\Omega$, $R_2 = 16\,\Omega$, $R_3 = 18\,\Omega$. Find R_T.

4. In Figure 2, if Emf = 6 V., $R_T = 18\,\Omega$, $R_1 = 24\,\Omega$, and $R_2 = 12\,\Omega$. Find R_1, I_T, I_1, I2, I3.

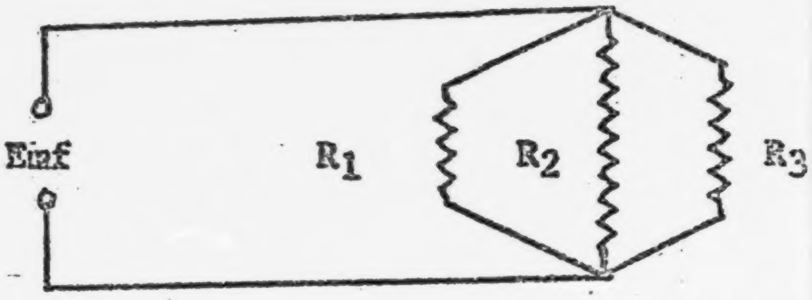


FIGURE 2

5. In Figure 3, if $R_1 = 30\,\Omega$, $R_2 = 12\,\Omega$, $R_3 = 16\,\Omega$, and $R_4 = 18\,\Omega$. Find R_T.

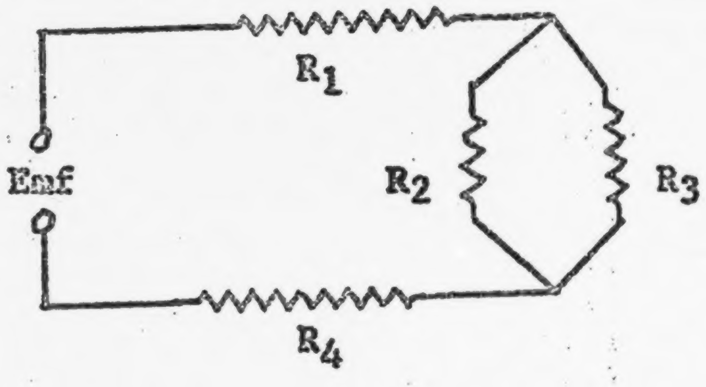


FIGURE 3

Lesson 21

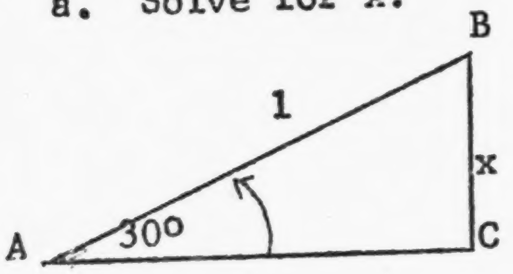
I. Review test.

II. Review of trignometry.

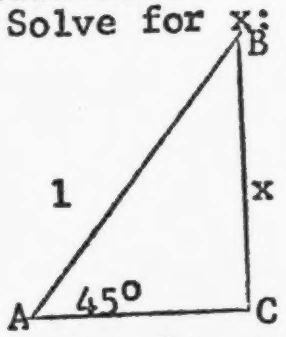
A. Trigonometric functions (review)

1. Solve right triangles using sine function.

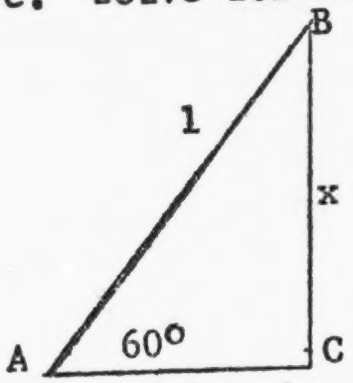
a. Solve for x:



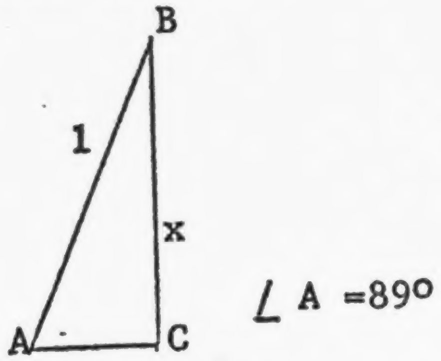
b. Solve for x:



c. Solve for x:



d. Solve for x:



2. Review the change in value of x as ∠A approaches 90°.

a. x approaches 1.

B. Classwork on work problems. (Teachers presentation)

1. Lines of force, 100 per cm, cut a conductor at 90°. The conductor, 1 cm long rotates 30°. Find the number of lines of force that will now cut the conductor.

a. Construct diagram.

b. Repeat problem above when AB rotates 45°.

c. Repeat problem when AB rotates 75°.

2. A field has 100 lines/cm. A conductor 5 cm long is perpendicular to the lines of force. How many lines of force intersect the conductor? If the conductor is rotated 30 degrees, how many lines of force will now be cut by the conductor?

C. Classwork at desk: ditto sheet.

D. Assignment: Complete problems 1 to 5.

IV

Name ____________________ Date __________

Lesson 21,
Assignment

For each exercise make a neat sketch, label all given data, and solve the problem.

1. A field has 100 lines of force per cm. A conductor 6 cm. long is perpendicular to the lines of force. How many lines of force intersect the conductor? If the conductor is rotated 30°, how many lines of force will be cut by the conductor?

2. Lines of force, 100 per cm., cut a conductor at 90 degrees. The conductor, 4 cm. long, rotates 30 degrees. Find the number of lines of force which will now cut the conductor.

3. A field has 80 lines of force per cm. A conductor 2 cm. long is perpendicular to the lines of force. How many lines of force intersect the conductor? If the conductor is rotated 45 degrees, how many lines of force will be cut by the conductor?

4. A field has 60 lines of force per cm. A conductor 2.5 cm. long is perpendicular to the lines of force. How many lines of force intersect the conductor? If the conductor is rotated 30 degrees, how many lines of force will be cut by the conductor?

5. A conductor 4 cm. long pases through a magnetic field at a speed of 5 cm. per second. If the magnetic field contains 100 lines of force per cm., find the number of lines of force cut by the conductor in one second if the conductor is perpendicular to the lines of force.

6. Find the number of lines cut by the conductor in problem (5) if the conductor cuts the field at a 45 degree angle.

7. A conductor 3 cm. long passes through a magnetic field at a speed of 5 cm. per second. If the magnetic field contains 60 lines of force per cm., find the number of lines of force cut by the conductor in one second if the conductor is perpendicular to the lines of force.

8. Find the number of lines cut by the conductor in problem (7) if the conductor cuts the field at a 30 degree angle.

9. A conductor 6 cm. long passes through a magnetic field at a speed of 4 cm. per second. If the magnetic field contains 80 lines of force per cm., find the number of lines of force cut by the conductor in one second if the conductor is perpendicular to the lines of force.

10. Find the number of lines cut by the conductor in problem (9) if the conductor cuts the field at a 40 degree angle.

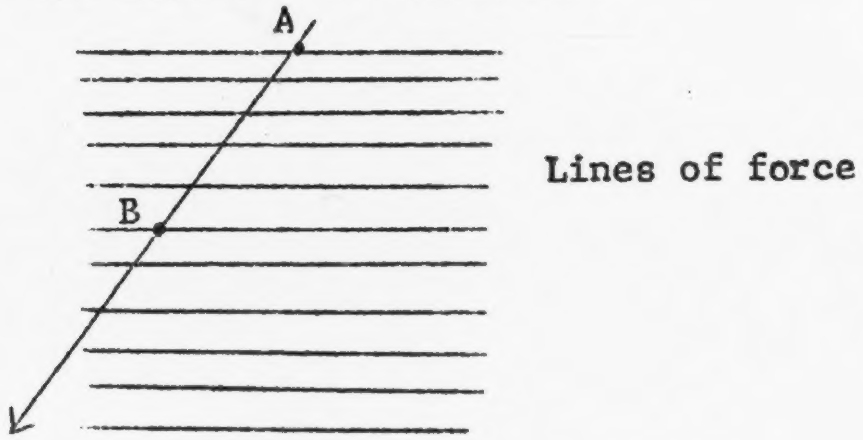
Lesson 22

I. Application of trigonometry to magnetic fields.

   A. Review homework.

   B. Extension of word problems.
      1. A conductor is moving 10 cm/sec through a field containing 50 lines of force/cm. If the conductor is 1 cm. long, how many lines of force will it cut in 5 seconds?
         Assume that the conductor is perpendicular to the lines for force.

      2. Repeat problem 1 of above assuming that the conductor has rotated 30°.
         a. Show diagram displaying direction of lines of force and movement of conductor.



   C. Classwork and Assignment: Ditto sheet 6 to 10. Problems similar to above.

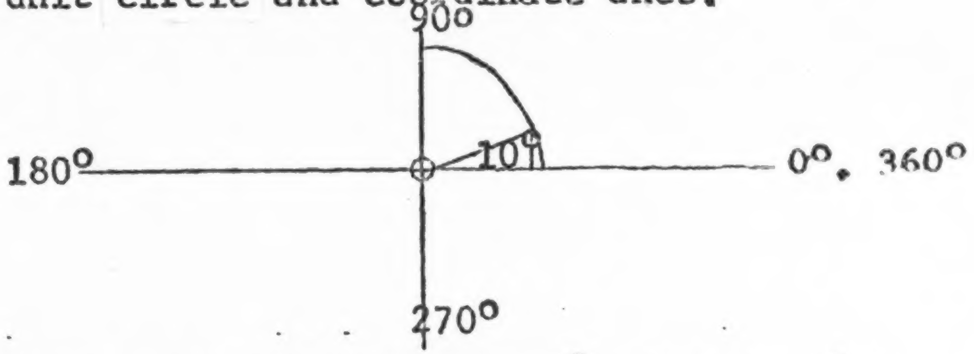
Lesson 23

I. Application of trigonometry to magnetic fields.

   A. Quiz

   B. Review quiz and homework.

   C. Develop the sine curve.
      1. Graph the values of the sine of an angle when the angle increases from 0° to 90°.
         a. Use a unit circle and coordinate axes.
            i.



            ii. Starting with an angle of 0° generate the values of sine x at 10° intervals.

IV

Name ________________ Date ____________

Lesson 23
Quiz

1. A conductor 2 cm. long passes through a magnetic field at a speed of 5 cm. per second. If the magnetic field contains 80 lines of force per cm., find the number of lines of force cut by the conductor in one second if the conductor is perpendicular to the lines of force.

2. Find the number of lines cut by the conductor if the conductor is cutting the field at a 45 degree angle.

IV

Name ________________ Date ____________

Lesson 27
Test

1. Determine the number of lines cut be a conductor 5 cm. long passing through a magnetic field containing 10 lines of force per cm. and the conductor is perpendicular to the lines of force and moving 25 cm. per second.

2. Make a sketch of the sine curve, indicating special points on the curve.

3. Find the value of sin 302°.

4. Find the value of sin 258°.

5. Find the value of sin 115°.

6. Graph the following: sin θ, when $90^\circ \leq \theta \leq 270^\circ$.

IV

Name ________________ Date ____________

Lesson 29
Quiz

1. Sketch the curve for a two-phase system.

2. By how many degrees does a three-phase system lag?

Lesson 23 (continued)

iii. Construct a chart of ordered pairs:

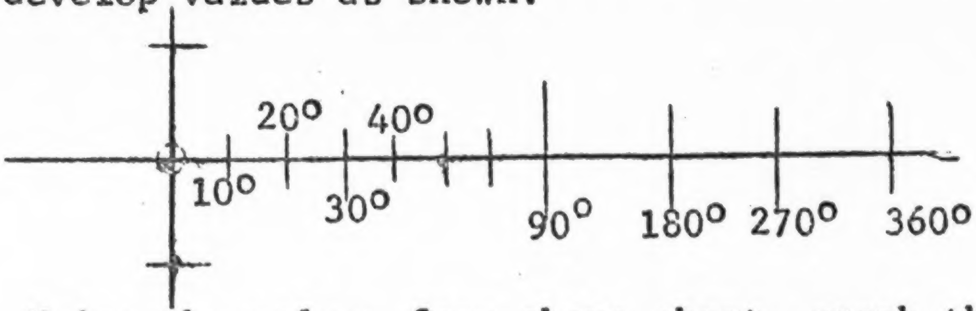
$\angle\theta$	$\sin\theta$
0°	
10°	
20°	
30°	
40°	
50°	
60°	
70°	
80°	
90°	

D. Find values of $\sin\theta$ from trigonometry.

Lesson 24

I. Graphing the sine function.

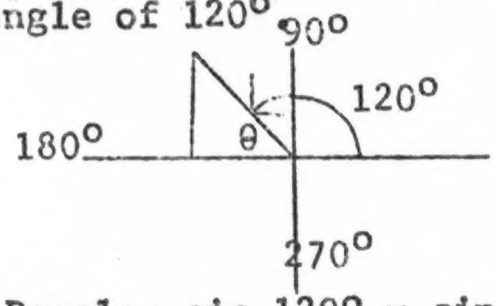
A. Using coordinate axes and letting the origin equal to 0° develop values as shown:



1. Using the values from above chart, graph the ordered pairs and connect with a smooth curve.
2. Discuss need to continue the curve to 360°.

B. Define the sine of an angle from 90° to 180°.

1. Using unit circle and coordinate axes, show an angle of 120°



a. Develop sin 120° = sin 60°.

Lesson 24 (continued)

2. Repeat for angles of 150°, 135°, 170°.
3. Develop chart of ordered pairs for the following angles: 100° to 180° in multiples of 10°.
4. Continue graph from part (b) above; 100° to 180°.

C. Continue development for third quadrant (180° to 270°).
  1. Show value of sine in third quadrant is negative.
  2. Develop similar chart to above and graph.

D. Continue development for fourth quadrant.

E. Examine some characteristics of the sine curve.
  1. Period of curve.
  2. Value of $\sin \theta$ when $\theta = 0^\circ, 180^\circ, 360^\circ$.
  3. Maximum and minimum points.
    a. Occur at 90° and 270°.

F. Classwork and Assignment: Using intervals of 15° and 0°, 90°, 180° and 270° graph the sine curve.

Lesson 25

I. Sine curve, values of sine in each of the four quadrants.

  A. Review development of sine curve in relationship to unit circle.
    1. Values of θ go from 0° to 360°.
      a. First quadrant, θ between 0 and 90°.
        i. Values of $\sin \theta$ when $0^\circ < \theta < 90^\circ$ are positive.

      b. Second quadrant, θ is between 90° and 180°.
        i. Values of $\sin \theta$ when $90^\circ < \theta < 180^\circ$ are positive.

      c. Third quadrant, θ is between 180° and 270°.
        i. Values of $\sin \theta$ when $180^\circ < \theta < 270^\circ$ are negative.

      d. Fourth quadrant, θ is between 270° and 360°.
        i. Values of $\sin \theta$ when $270^\circ < \theta < 360^\circ$ are negative.

      e. Values:
        i. $\sin 0^\circ = 0$
        ii. $\sin 90^\circ = 1$
        iii. $\sin 180^\circ = 0$
        iv. $\sin 270^\circ = -1$
        v. $\sin 360^\circ = 0$

Lesson 25 (continued)

2. Develop formula for $\sin\theta$ when $90^\circ < \theta < 180^\circ$.
    a. $\sin\theta$ when $90^\circ \quad \theta \quad 180^\circ$ is $\sin(180^\circ - \theta) = \sin\theta$
        i. Example: Find $\sin\theta$ when $\theta\ 120^\circ$.
        Solution: Since $90^\circ < 120^\circ < 180^\circ$ we have
        $\sin\theta = \sin(180^\circ - \theta) = \sin\emptyset$
        $\sin 120^\circ = \sin(180^\circ - 120^\circ) = \sin 60^\circ = .866$

3. Classwork: Using above example find the sin of the following angles: 110°, 135°, 150°, 160°.

4. Develop formula for $\sin\theta$ when $180^\circ < \theta < 270^\circ$.
    a. $\sin\theta$ when $180^\circ < \theta < 270^\circ$ is $\sin(180^\circ + \theta) = -\sin\emptyset$ where $\theta = (180^\circ + \emptyset)$
        i. Example: Find $\sin\theta$ when $\theta = 210^\circ$.
        $\sin\theta = \sin(180^\circ + \emptyset) = -\sin\emptyset$
        $\sin 210^\circ = \sin(180^\circ + 30^\circ) = -\sin 30^\circ = -.5$

    b. Using the above example, find the sine of the following angles: 200°, 225°, 240°, 250°

5. Develop formula for $\sin\theta$ when $270^\circ \le \theta < 360^\circ$.
    a. $\sin\theta$ when $270^\circ \quad \theta \quad 360^\circ$ is $\sin(360^\circ - \theta) = \sin\emptyset$ where $\emptyset = (360^\circ - \theta)$
        i. Example: Find $\sin\theta$ when $\theta = 330^\circ$.
        $\sin\theta = \sin(360^\circ - \theta) = -\sin\emptyset$ where $\emptyset = (360^\circ - \theta)$
        $\sin 330^\circ = \sin(360^\circ - 330^\circ) = -\sin 30^\circ = -.5$

    b. Using the above example, find the sine of the following angles: 290°, 300°, 315°, 350°.

B. Assignment: Find the sine of the following angles:

1. 80°
2. 112°
3. 198°
4. 262°
5. 359°
6. 95°
7. 167°
8. 273°
9. 352°
10. 241°

Study formulas for sine of an angle in each of the quadrants. Test in 2 days.

Lesson 26

I. Sine curve value of sine in a unit circle.

A. Quiz: Find the sine of the following angle: $\phi\ 155^\circ$.

B. Review formulas and give an example for finding sine of an angle in the second, third and fourth quadrants.

1. $\sin\theta = \sin(180^\circ - \theta) = \sin\phi$ when $90^\circ < \theta < 180^\circ$ and where $\phi = 180^\circ - \theta$

2. $\sin\theta = \sin(180^\circ + \phi) = -\sin\phi$ when $180^\circ < \theta < 270^\circ$ and when $\phi = (\theta - 180^\circ)$ or $(180^\circ + \phi) = \theta$

3. $\sin\theta = \sin(360^\circ - \theta) = -\sin\phi$ when $270^\circ < \theta < 360^\circ$ and where $\phi = 360^\circ - \theta$
   a. Note: When $180^\circ < \theta < 360^\circ$ the sine of θ is always negative.

C. Review homework.

D. Classwork: Graph the following: Sin θ when θ is 0°, 30°, 45°, 60°, 90°, 120°, 135°, 150°, 180°, 210°, 225°, 240°, 270°, 300°, 315°, 330°, 360°.

1. The complete graph of the $\sin\theta$ when $0^\circ \leq \theta < 360^\circ$ is called the sine curve.
   a. The graph from 0° to 360° is one period.
   b. The maxiumm and minimum values are the greatest and least magnitude of the graph.
   c. Used widely in electricity.

E. Assignment: Complete classwork. Study for test.

Lesson 27

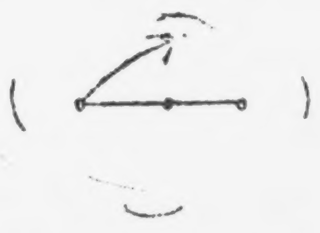
I. Test on ditto sheet.

Lesson 28

I. Sine curve, 2 phase and 3 phase systems.

A. Review test.

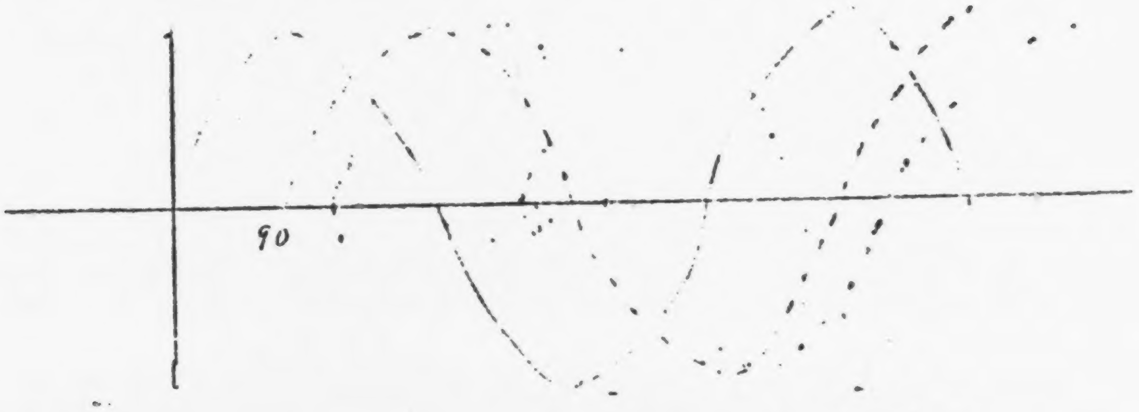
B. Introduce graph for 2 phase system.
1. Log 90°.
   a. Diagram of generator producing 2 phase energy.



i. Borrow model from electricity lab.

Lesson 28 (continued)

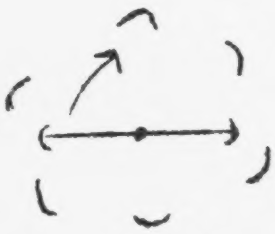
2. Graph of 2-phase system.



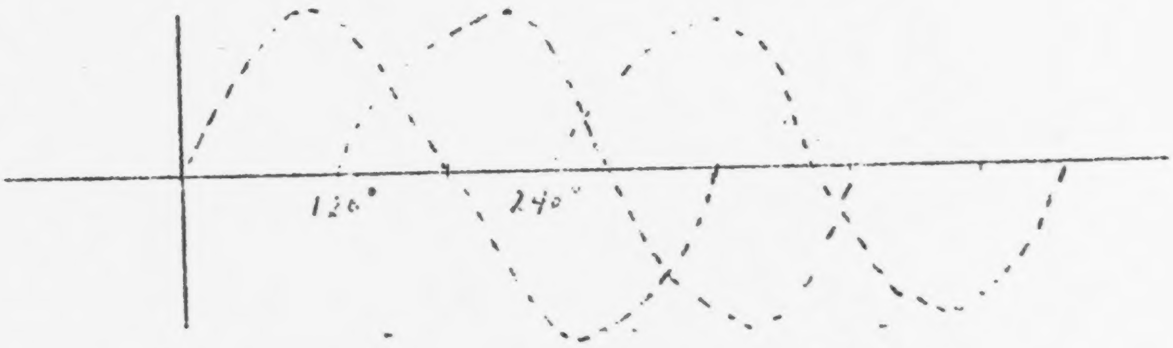
a. Refer to D.C. generator for clarity.

3. Discuss changes in magnitude and amperes.

C. Introduce graph for 3-phase system.
   1. Log of 120°.
      a. Diagram of generator producing 3-phase energy.



2. Graph of 3-phase system.



i. Compare with graph of 2-phase.

D. Assignment:
   1. Graph the sine curve for a 2-phase system.
   2. Graph the sine curve for a 3-phase system.

Lesson 29

I. Sine curve, 2-phase and 3-phase systems.

  A. Quiz

  B. Review of two-phase system.
    1. Sketch graph.
      a. Note 90° log.

  C. Review of three-phase system.
    1. Sketch graph.
      a. Note 120° log.

  D. Review of sine function of any angle.
    1. Extend graph for three cycles.
      a. Show sine 0° = sin 180° = sin 360° = sin 720° etc.

  E. Assignment: Begin work on review notes and ditto sheets.

Lessons 30 to 35

I. Ditto sheets on review for years work.

Name ______________________ Date ___________

Lesson 29
Review, Unit I

I. Identify the variables and the type of variation as "direct variation", "inverse variation", or "other".

1. Ten men can paint a building in eight days, but 5 men must take sixteen days.

2. Ten men can accomplish five times as much work as two men in the same length of time.

3. I can travel twice as far at 40 mph as I can at 20 mph in the same length of time.

4. $C = 2\pi r$
5. $\frac{k}{n} = 12$

II. Find the trigonometric function of the given angle using your tables.

1. Tan 58°
2. cos 32°
3. Sin 63°
4. Ctn 40°
5. Csc 25°
6. Sec 75°

III. Solve each problem by making a sketch, labeling the given dimensions, and indicating the function used.

1. In right triangle ABC, angle A is a right angle, angle B is 38°, and side BC is 25 cm. Find side AB.

2. In right triangle ABC angle C is the right angle. Angle A measures 65 degrees, and side AC is 38 cm. Find the length of AB.

Name ____________________ Date __________

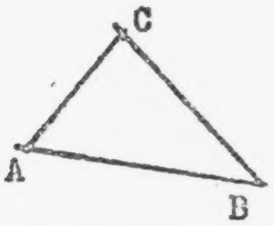
Lesson 30
Review, Unit II

1. Two men push a large machine nine feet south and 5 feet east. What is the straight-line distance between its starting and finishing points?

2. A man making deliveries from his store traveled seven blocks west, then two blocks north, 5 blocks west, two blocks north, four blocks west, and finally two blocks north. What is the straight-line distance in "blocks" from his store to his finishing point? What is the straight-line distance between these two points? (Note the different use of the words "block".)

3. A boat traveled five miles south on a lake and then 3 miles east. If the boat had taken a straight course to its destination, how far would it have traveled?

4. Using the Law of Cosines, find the missing side length in the triangle.



Given: angle $A = 60^\circ$
$b = 15'$
$c = 16'$

5. Resolve a force of 80 lbs into two components, each of which makes an angle of 60 degrees with it.

6. Resolve a force of 80 lbs into two components, each of which makes an angle of 20 degrees with it.

7. Resolve a force of 80 lbs into two components, each of which makes an angle of 40 degrees with it.

Name ____________________ Date ____________

Lesson 31
Review, Unit III

1. Solve:

$$\frac{x}{100} = \frac{35}{50}$$

2. Solve:

$$\frac{x}{100} = \frac{17}{35}$$

3. Find the percent corresponding to 90 out of 115.

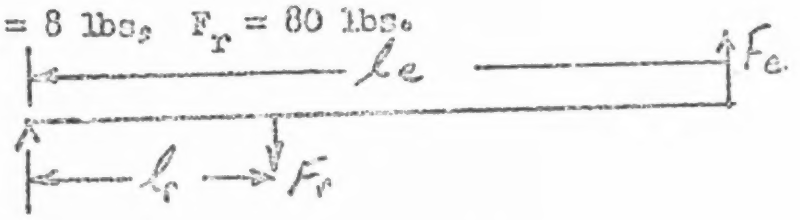
4. Find the percent corresponding to 1.95 out of 9.5.

5. A block and tackle lifted a machine weighing 3800 lbs to a height of seven feet. Find the work done.

6. A crane lifted a ship weighing 18,500 lbs half a foot off the ground. Find the work done.

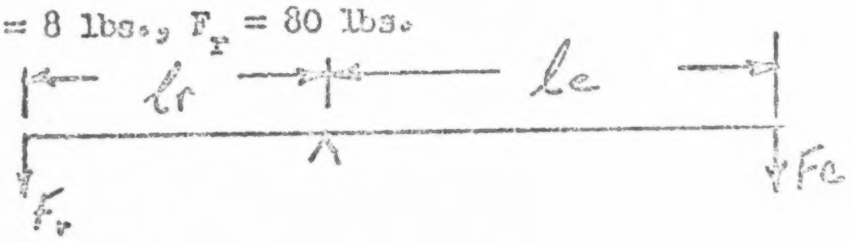
7. In the figure below a lever is illustrated. Find ℓ_r.

$\ell_e = 20''$, $F_e = 8$ lbs, $F_r = 80$ lbs.



8. Using the figure of a lever below, find L_r.

$L_e = 20''$, $F_e = 8$ lbs., $F_r = 80$ lbs.



9. A force of 480 lbs is applied to a lever 12 feet from the fulcrum. The lever weighs 20 lbs. If the length of the resistance arm is 6 feet, find the weight of the heaviest object which the 80 lb. force can lift.

10. Find the speed ratio of three gears if the driver gear has nine teeth, the second gear has 18 teeth, and the driven gear has 36 teeth.